LonMaker™ User's Guide

Release 3.1

Revision 2

ECHELON® Corporation

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Welcome

Welcome to the LonMaker™ Integration Tool Release 3.1—a software package for designing, installing, and maintaining multi-vendor, open, interoperable LONWORKS® control networks. Based on Echelon's LNS™ network operating system, the LonMaker tool combines a powerful, client-server architecture with an easy-to-use Visio user interface. The result is a tool that is sophisticated enough to design, commission, operate, and maintain a control network, yet economical enough to be left behind as an operation and maintenance tool. The LonMaker tool complies with the LNS plug-in standard, making it compatible with the wide variety of LNS plug-ins that are available from Echelon and many other vendors.

Purpose

The *LonMaker User's Guide* and Help files describe how to design, commission, manage, and maintain a network using the LonMaker Integration Tool. It also outlines the new features in Releases 3.13, 3.1, and 3.

Audience

The *LonMaker User's Guide* and Help files are intended for system designers and integrators with an understanding of control networks. LonMaker users should also be familiar with Visio 2002.

Related Reading

i.LON™ 1000 Internet Server User's Guide - Describes how to install, configure, use, and manage the *i*.LON 1000 server as a router and Web server.

i.LON 100 Internet Server User's Guide - Describes how to install, configure, use, and manage the *i*.LON 100 server as a Web server, network interface, and LONWORKS device.

Introduction to the LONWORKS System - Introduces the basics of the LONWORKS system.

LNS Utilities and LONMARK Reference Help File - Describes the LNS utilities included with the LonMaker tool and provides reference documentation on LONMARK resource files, device interface files, and standard network variable and configuration property type definitions.

NodeBuilder User's Guide – Describes how to use the NodeBuilder tool in concert with the LonMaker tool to develop and test device applications.

Microsoft Visio Professional Edition User's Guide, Version 2002 - Describes how to use Visio 2002 Professional Edition.

Microsoft Visio Standard Edition User's Guide, Version 2002 - Describes how to use Visio Standard 2002.

Developing Visio Solutions for Microsoft Visio 2002 - Describes *how to customize Visio 2002.*

Go to the LonMaker home page at www.echelon.com/lonmaker for the latest versions of documentation and any available updates for your software. Go to types.lonmark.org for updated resource file documentation.

Content

The *LonMaker User's Guide* includes the following content:

- *Introduction*: Provides an introduction to the LonMaker tool, new features in LonMaker 3.13, 3.1, and 3, LonMaker network designs, LONWORKS Basics, and Visio Basics.
- *Getting Started*: Provides information on hardware requirements, installation of the various LonMaker tool components, a quick-start tutorial, the LonMaker Design Manager, creating and opening a LonMaker network design, using the LonMaker tool remotely, and backing up and restoring LonMaker Networks.
- *Designing Networks*: Provides information on designing networks, optimizing network performance, navigating the subsystem hierarchy, next steps, and controlling access with user profiles.
- *Creating Networks*: Includes information on creating networks (such as creating a LonMaker drawing, subsystems, devices, i.LON Internet Server, supernodes, channels, functional blocks, and connections); working with LonMaker shapes and layers; customizing the LonMaker user interface; using LonMaker demo mode and using LonMaker with AutoCAD drawings.
- *Installing Networks*: Covers commissioning devices and routers, and creating a network service device.
- *Maintaining Networks*: Describes loading devices, replacing devices and routers, using LonMaker styles, and merging LonMaker networks.
- *Managing Networks*: Provides information on managing devices, functional blocks, routers, and subsystems.
- *LonMaker Credits*: Provides information on licensing; using, viewing and adding LonMaker credits; and transferring a LonMaker license.
- *Using LNS Plug-ins*: Provides an overview of LNS plug-ins and then describes starting a plug-in, getting plug-in information, and re-registering plug-ins.
- *Monitoring and Controlling Devices*: Provides an overview of monitor and control functions with LonMaker and then gives directions on setting browser options, changing types and formats, monitoring connections, and binding network variables to the host.
- *Creating and Using LonMaker Shapes and Stencils*: Describes LonMaker stencils and the process to create them; creating and using custom master shapes for devices, functional blocks, subsystems, and connections; additional user cells for devices, functional blocks, and routers; and setting user-defined functional block modes and types.
- *Creating HMI Applications*: Describes using the LonMaker tool for human machine interface (HMI) applications, the LNS text box, third-party ActiveX controls, and custom LNS-based ActiveX controls.
- *Appendices*: Include the LonMaker Credits Order Form, instructions for installing network drivers, the LonMaker Software License Agreement, LonMaker License Transfer Agreement, and a Glossary.

For More Information and Technical Support

See the *LonMaker User's Guide*, the *LonMaker for Windows* help file, the *LonPoint Application and Plug-In Guide*, and the *LonPoint Plug-In* help file for detailed information on using the LonMaker tool and the LonPoint plug-in. Adobe Acrobat versions of the *LonMaker User's Guide* and *LonPoint Application and Plug-In Guide* are also included in LonMaker and LonPoint program folders when you install the LonMaker and LonPoint software. You'll need the Adobe Acrobat reader that is optionally installed by the LonMaker setup application to view these files.

See the LonMaker and LonPoint Plug-In ReadMe files for descriptions of known problems and workarounds. To view the LonMaker ReadMe file, click the Windows **Start** button, point to

Programs, select the **Echelon LonMaker for Windows** folder, then select **Read Me First**. To view the LonPoint ReadMe file, click the Windows **Start** button, point to **Programs**, select the **Echelon LonPoint Device Software** folder, then select **Read Me First**.

You can also find additional LonMaker and LonPoint information at the LonMaker Home Page at www.echelon.com/lonmaker.

If you have technical questions that are not answered by the documentation, on-line help, or LonMaker home page, you can get technical support from Echelon. Your LonMaker distributor may also provide customer support. You can also enroll in training classes at Echelon to learn more about how to use the LonMaker tool To receive technical support from Echelon for the LonMaker tool, you must register your copy with Echelon and you must purchase one of Echelon's incident-based support services. Detailed information about Echelon's support and training services may be found on the Echelon Support home page at www.echelon.com/support. There is no charge for software installation-related questions during the first 30 days after you receive the LonMaker CD. You can obtain technical support via phone, fax, or email from your closest Echelon support center. The contact information is listed in the following table.

Caution *The support programs and the information in the following table are subject to change. See the Echelon Services home page at www.echelon.com/support for a description of the current offerings and support contracts. Your LonMaker distributor may provide you with alternate contacts for support.*

	London	San Jose	Tokyo
Language	English/French/ German/Italian	English	Japanese
Hours (Mon-Fri*)	0900-1700 London Time	8:30am-4:30pm PDT	0900-1700 Tokyo Time
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Email	lonsupport@echelon.co.uk	lonsupport@echelon.com	lonsupport@echelon.co.jp

*Excluding holidays at center location

Echelon will provide Visio support only for those Visio features that are required for use of the LonMaker tool. To receive support for Visio from Microsoft, you must separately purchase a retail version of the Microsoft Visio Professional or Standard 2002 drawing application. Echelon will not support use of the LonMaker tool with versions of Visio other than the version included on the LonMaker CD.

Your suggestions on how to improve the product's functionality and documentation are always welcome. Please send your comments to lonmaker@echelon.com (please do not use this address for technical support questions; technical support questions should be sent to lonsupport@echelon.com, lonsupport@echelon.co.uk, or lonsupport@echelon.co.jp).

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1

Introduction

This chapter provides an introduction to the LonMaker tool; describes new features in LonMaker 3.13, LonMaker 3.1, and LonMaker 3; and introduces LonMaker network designs, LONWORKS basics, and Visio basics.

Introduction to the LonMaker Tool

The LonMaker™ Integration Tool is a multipurpose LONWORKS® network tool that runs on a computer under the Windows XP, Windows 2000, and Windows 98 operating systems and uses Microsoft Visio® Professional or Standard 2002 as a graphical interface. The LonMaker tool functions as the following:

- *Network Design Tool* – The LonMaker tool allows you to design a network without being connected to it. This allows network design to be done off site (*engineered system installation scenario*). The LonMaker tool also allows network design to take place on site (*ad-hoc installation scenario*), which may be desirable for smaller networks or networks in which the network topology is unknown until on-site. The LonMaker tool can learn the design from an existing network; this process is called *recovery*. The LonMaker tool also enables an engineered, ad-hoc, or recovered network to be changed at any time.
- *Network Installation Tool* – The LonMaker tool allows an engineered network to be rapidly installed once the network design is brought on site. The engineered device definitions can be quickly and easily associated with their corresponding physical devices to reduce on-site commissioning time. The LonMaker Browser provides complete access to all network variables and configuration properties.
- *Network Documentation Tool* – Since the LonMaker tool creates a Visio drawing in parallel with the network design and installation process, this drawing accurately represents the installed network, making it an essential component of as-built reports.
- *Network Operation Tool* – The LonMaker tool supports the operation of a network using operator interface pages contained within the LonMaker drawing.
- *Network Maintenance Tool* – The LonMaker tool allows devices, routers, channels, subsystems, and connections to be easily added, tested, removed, modified, or replaced to support system maintenance.

This versatility allows the LonMaker tool to be used as a single-tool solution for all phases of a network's life cycle: from initial design and commissioning to ongoing operation and maintenance.

The LonMaker tool runs on the *LNS*™ network operating system. LNS provides the essential directory, installation, management, monitoring, and control services required for open LONWORKS networks. LNS is a standard platform that allows multiple LNS applications such as the LonMaker tool, LNS plug-ins, and the LNS DDE Server to interoperate on the same computer or on multiple computers on the same network.

LNS is a client-server operating system with a single *LNS Server* that supports many interoperating client applications. You can run the LNS Server as a standalone application on a computer attached to the network, or you can run the LNS Server on the same computer with the LonMaker tool. Clients on other computers (called *remote clients*) can log into the LNS Server to access the shared LNS database.

The LonMaker tool uses the client-server capabilities of LNS to allow multiple LonMaker tools running on different computers to simultaneously access the same LNS Server. This capability allows multiple users to work at the same time on a single network. For more information, see *Using the LonMaker Tool Remotely*.

LonMaker Network Designs provides an overview of the components of a LonMaker network design: an LNS network database and a LonMaker drawing.

LONWORKS Basics provides an important introduction to the structure of a LONWORKS network, the channels connecting it to an LNS Server, the LonMaker computer, LonMaker client types, and related terms.

Visio Basics provides an introduction to the powerful graphical interface used in creating a LonMaker drawing.

New Features in Release 3.13

Release 3.13 of the LonMaker Integration Tool includes enhancements to the following areas:

- Support for three editions of the LonMaker tool—Professional, Standard, and Trial.
- xDriver support.

Professional, Standard, and Trial Editions

Starting with release 3.13 of the LonMaker tool, three editions are available—Professional, Standard, and Trial. These editions differ in what edition of Visio 2002 is included, how many LonMaker credits are included, and how long the software functions.

Professional Edition

- Ships with Visio Professional 2002 with Service Release 1. This version of Visio includes all the features of Visio Standard with the addition of support for engineering drawings; building space, and floor plans; network diagrams; directory services diagrams; Web site maps; and software/database diagramming with reverse engineering. Drawings created with Visio Professional 2002 can be opened by Visio Standard 2002. See the Visio Professional documentation for more details on these features.
- Comes with 64 LonMaker credits. You can purchase additional credits as described in Chapter 8.
- No time limit on operation.

Standard Edition

- Ships with Visio Standard 2002 with Service Release 1.
- Comes with 5 LonMaker credits. Additional credits can be purchased as described in Chapter 8.

Trial Edition

- Ships with Visio Professional Trial 2002 with Service Release 1. This version of Visio includes all the features of Visio Professional 2002, but expires after 30 days.
- All drawings created with this version include the words "LonMaker Demonstration Network" in large gray letters in the background.
- Networks are limited to 6 devices maximum. You cannot order LonMaker credits.
- Quits functioning after 30 days. To continue using the LonMaker tool after 30 days, you must license the LonMaker Professional or Standard Edition.

xDriver Support

Version 3.13 includes the LNS xDriver, which allows you to use *i*.LON 10 and *i*.LON 100 Internet Servers as LONWORKS remote network interfaces. This allows you to use the LonMaker tool remotely from your network, using an Internet connection to your network via the *i*.LON 10 or *i*.LON 100. See the documentation for these devices for more information. As with LonMaker 3, LonMaker 3.13 can also be used with the i.LON 1000 Internet Server, which functions as a router instead of a remote network interface, providing a higher performance interface.

New Features in Release 3.1

Release 3.1 of the LonMaker Integration Tool includes enhancements in the following areas. These are described in the following sections.

- Enhancement to support more LONMARK® features.
- Performance improvements.
- Network design improvements.

LONMARK Enhancements

New features include the following:

- You can add dynamic network variables to any functional block, for devices that support this feature.
- Improved support for changeable network variable type and size using the new `SCPTnvType` configuration property.
- Color coding in the LonMaker browser to show what values can be edited.
- LonMaker browser support for long configuration property types.

Performance Improvements

New performance improvements include the following:

- Large drawing resynchronization is much faster.
- You can suppress address table and network variable configuration table updates to the source device for a connection, making the device responsible for managing the destination addresses and allowing more complex connection topologies.

Network Design Improvements

New network design features include the following:

- You can automatically add network variable shapes to a functional block when you create the functional block.
- You can now change alias options for a connection.

Other New Features

Other new features include the following:

- You can refresh a drawing to support plug-ins modifying the LNS database.

New Features in Release 3

Release 3 of the LonMaker Integration Tool includes enhancements in the following areas. These are described in the following sections.

- Design automations reduce engineering time
- User efficiency improvements reduce installation time
- Network recovery reduces maintenance costs for legacy systems
- Network merge speeds installation of large systems

- Human-machine interface (HMI) support provides a single tool solution for network design, installation, and operation

Design Automations

New features and the resulting benefits in design automation include the following:

- Supernode master shapes simplify reuse of frequently used designs
- Batch operations eliminate repetitive operations
    - Create up to 64 devices of the same type with one operation
    - Create up to 64 functional blocks of the same type with one operation
    - Create peer-to-peer connections, fan-in/fan-out connections, and configuration changes as a batch operation
- New and enhanced solutions in Visio 2002 reduce time to create common drawings (these are only available with the LonMaker Professional Edition)
    - Improved HVAC control logic diagrams
    - Improved facilities diagrams
    - Improved plant layouts, network diagrams, piping and instrumentation diagrams, plumbing and piping plans, floor plans, and more
- LonMaker Network Explorer simplifies navigation through large systems
- Visio pan and zoom window simplifies navigation within pages

These new features reduce engineering time and cost.

User Efficiency Improvements

New features that improve user efficiency include the following:

- Multi-device operations reduce time required to commission, replace, and upgrade related devices
- New *i*.LON™ 1000 shape reduces time required to commission and replace *i*.LON 1000 devices
- Enhanced shape styles simplify diagnostics and reduce time to bring up subsystems
- Batch commissioning plug-in available for free download as described under New Plug-Ins below

These enhancements reduce installation time and cost.

Network Recovery

The LonMaker tool now includes network recovery that allows you to do the following:

- Use the LonMaker tool with legacy networks installed with previous generation tools and networks that do not have a network database
- Automatically create both an LNS database and a LonMaker drawing
    - Automatically create an LNS database from an existing network
    - Recover device names from a LonManager API database
    - Automatically create a LonMaker drawing from an LNS database

Network recovery reduces maintenance costs for legacy systems.

Network Merge

With the new network merge feature, you can do the following:

- Create a single LonMaker network from two independent networks. The new network contains all the devices, connections, and configuration of the two networks.
- Independently engineer, install, and verify independent systems. After verification, these systems can be merged into a single network for ease of system operation, data sharing, and maintenance.

Network merge facilitates faster installation of large systems.

Examples of using the network merge capability include the following:

- Multiple-story building

  Step 1: Independently commission and verify each floor as a separate network

  Step 2: Merge the floors to create a single network

- Building with multiple independent integrators

  Step 1: Independently commission and verify each system (HVAC, lighting, and security, for example) as a separate network

  Step 2: Merge the subsystems to create a single network

The above examples can be combined for a building with multiple stories and multiple integrators.

HMI Support

- Used to create HMI applications. This capability is not a replacement for high-end HMI tools, such as Wonderware InTouch, but it is adequate for many systems.
- Use the following HMI tools with the LonMaker tool:
  - Visio supports ActiveX controls
  - Visual Basic for Applications (VBA) scripting language is included with Visio
  - LNS Text Box (new release) is an ActiveX control that can display and update any network variable, any configuration property, and any functional block override (new)
  - Optional third-party ActiveX controls, such as National Instruments ComponentWorks, and link to LNS Text Box using VBA

Benefits of the enhanced LonMaker HMI capabilities include the following:

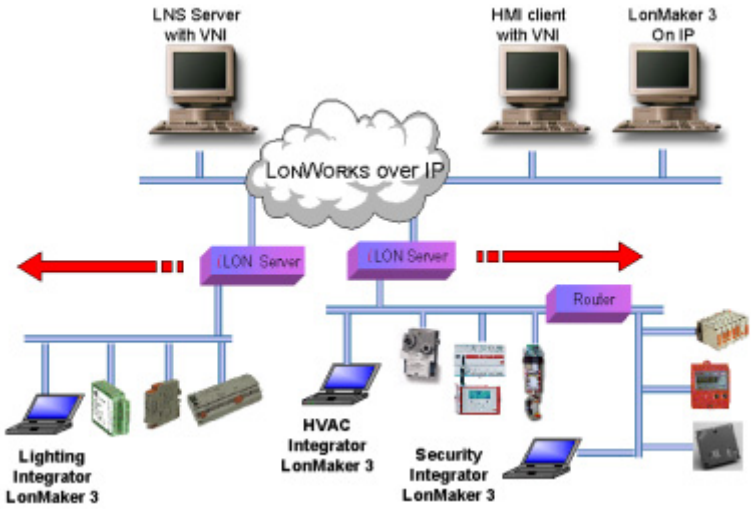
- Use a single tool to design, commission, and operate a network, which results in lower cost and is easier to learn.
- Can be left behind to support both system operation and on-site maintenance. LonMaker user profiles can be used to control access to the LonMaker tool. Therefore, operators can interact with the HMI, but cannot change the network design or installation. Integrators can maintain full access.

Other New Features

The LonMaker tool version 3 includes many other new features, such as the following:

- LNS 3 enhancements reduce design, commissioning, and maintenance time and improves monitoring and control performance

- Optional graphics on device shapes, which supports differentiation by original equipment manufacturers (OEMs)
- LNS 3 combined with the *i*.LON 1000 Internet Server creates many possibilities. The graphic below shows one example.



New Plug-ins

Although not part of the LonMaker 3 product, a number of new plug-ins are available that are compatible with LonMaker 3. For a complete list of available plug-ins, see www.echelon.com/plugins. Many of the plug-ins listed here are available for free download. Besides the many device plug-ins listed, there are several new general-purpose plug-ins.

LonMaker Network Designs

You will use the LonMaker tool to create, install, document, operate, and maintain *LonMaker network designs*. A LonMaker network design consists of an *LNS network database* and a *LonMaker drawing*.

An *LNS network database* contains definitions of the devices contained within a LonMaker network, including information such as name, address, application configuration, and network connections for each device. Whenever you change to a LonMaker drawing, the LonMaker tool automatically uses LNS services to update the information in the LNS network database associated with the LonMaker drawing.

There is only one LNS network database per network, and the LNS network database is always located on the computer with the LNS Server. You can maintain backup copies of the LNS network database, and you can move the LNS Server and LNS network database to a backup computer. See *Using LonMaker Backup Files* for more information.

A *LonMaker drawing* contains the graphical representation of the LonMaker network. A LonMaker drawing consists of one or more drawing files; each drawing file consists of one or more pages, each page represents an *LNS subsystem*. One drawing file is designated as the *top-level drawing file*; this drawing file is the one created when you create a new LonMaker network design.

A LonMaker drawing is always located on the computer running the LonMaker tool. If you are running multiple LonMaker tools on the same LonMaker network, each computer running a

LonMaker tool must have a copy of the LonMaker drawing. Multiple-user operation is described under *Using the LonMaker Tool with Multiple Users*.

LONWORKS Basics

This section provides an overview of the following topics and defines related terms:

- LONWORKS networks
- Network channels
- LonMaker client types

The *Glossary* in Appendix E provides a quick reference for specific terms.

LONWORKS Networks

A LONWORKS network consists of intelligent *devices* (such as sensors, actuators, and controllers) that communicate with each other using a common *protocol* over one or more *communications channels*. Network devices are sometimes called *nodes*.

Each *device* includes one or more processors that provide its intelligence and implement a communications protocol. Each device also includes a component called a *transceiver* to provide its electrical interface to the communications channel.

A device publishes information as appropriate to the application that it is running. The applications on different devices are not synchronized, and it is possible that multiple devices may all try to talk at the same time. Meaningful transfer of information between devices on a network, therefore, requires organization in the form of a set of rules and procedures. These rules and procedures are the *communication protocol*, often called the *protocol*. The protocol defines the format of the messages being transmitted between devices and defines the actions expected when one device sends a message to another. The protocol normally takes the form of embedded software or firmware code in each device on the network. The protocol used on LONWORKS networks is defined by the ANSI/EIA/CEA-709.1 standard. Echelon's implementation of this standard is called the *LonTalk® protocol*.

A *device template* is a template used by LNS that defines the information published and consumed by a given device type (functional blocks, network variables, configuration properties, and so on). For example, the Echelon LonPoint™ devices all have associated device templates. When you drag a LonPoint device shape to a LonMaker drawing, the LonMaker tool creates the new device according to that device template.

Channels

The path between devices exhibits various physical characteristics and is called the *communications channel*, or simply *channel*. Different transceivers may be able to interoperate on the same channel, so channels are categorized by *channel type*, and every type of transceiver must identify the channel type or types that it supports. The choice of channel type affects transmission speed and distance as well as the network topology.

Multiple channels can be connected using *routers*. Routers are used to manage network message traffic, extend the physical size of a channel (both length and number of devices attached), and connect channels that use different media (transceiver types) together. Unlike other devices, routers are always attached to two channels.

Applications

Every device must contain an *application*. The application may be in a device when you purchase it, or you may load it into the device from application files (.apb and .nxe extensions) using the LonMaker tool. The application helps determine how a device functions.

Applications may contain the following variables and properties, which are defined in the device template:

Network variables	Data items (such as temperature, switch value, or actuator position setting) that a particular device application program expects to receive from other devices on the network (an *input network variable*) or expects to make available to other devices on the network (an *output network variable*). Network variables allow a device to send and receive data over the network to and from other devices.
Configuration properties	Data items that define configuration options for a device application. The application reads the values from the network variables and configuration properties and performs functions upon them. For example, an application may allow an arithmetic function (add, subtract, multiply, or divide) to be performed on two values received from two network variables. The function to be performed could be determined by a configuration property.

Every network variable and configuration property has a type, which determines the content and structure of the data. The LONMARK Interoperability Association defines the following types:

Standard Configuration Property Types (*SCPTs*, pronounced *skipits*)	Contain many common configuration data types. For example, SCPT_location is a configuration property type for configuration properties containing the device location as a text string
Standard Network Variable Types (*SNVT*s, pronounced *snivits*)	Contain many common operational data types. For example, SNVT_temp_f is a network variable type for network variables containing temperature as a floating-point number

See types.lonmark.org for a list and description of all SNVTs and SCPTs.

Applications may use manufacturer-defined non-standard types — user network variable types (UNVTs) and user configuration property types (UCPTs) — which are defined in user resource files.

Device manufacturers may provide additional resource files that define these types. See types.lonmark.org for additional information on creating or using these files.

Applications in devices are divided into one or more *functional blocks*. A functional block is a collection of network variables and configuration properties, which are used together to perform one task. For example, a LonPoint DI-10 module has four digital input functional blocks that contain the configuration properties and output network variable for each of the four hardware digital inputs on the DI-10 device.

The application program in a device does not need to know anything about where input network variables come from or where output network variables go. When the application program has a changed value for an output network variable, it simply passes the new value to the device firmware. Through a process called *binding* that takes place during network design and installation, the device firmware is configured to know the logical address of the other device or group of devices in the network expecting that network variable. It assembles and sends the appropriate packets to these devices. Similarly, when the device firmware receives an updated value for an input network variable required by its application program, it passes the data to the application program. The binding process thus creates logical *connections* between an output

network variable in one device and an input network variable in another device or group of devices. Connections may be thought of as "virtual wires."

Subsystems

Devices, routers, and functional blocks are contained in *subsystems*. With the LonMaker tool, each subsystem corresponds to one page within a LonMaker drawing. Subsystems allow you to place devices, routers, and functional blocks onto separate pages for organizational purposes. You may also place subsystems in other subsystems, allowing you to create a subsystem hierarchy for large networks. For example, a network may consist of HVAC, lighting, security, and operator subsystems. These may be further divided into subsystems for each floor, and each floor divided into subsystems for each room.

Using the LonMaker tool, you can also use subsystems to create *supernodes*. A supernode is a subsystem with its own network variable interface. Supernodes may be used to organize groups of devices into logical units and to hide complex subsystem details, exposing only the most important network variables. This structure reduces errors and decreases the time required for network engineering and commissioning. A network variable interface for a supernode may contain any network variable on any device found within the supernode or its nested subsystems.

Network Channels

The physical or LONWORKS network, an LNS Server computer, and a computer running the LonMaker tool can communicate with each other using the following network channels:

- LONWORKS channel
- LONWORKS/IP channel
- LNS/IP channel

A *LonWorks channel* is a communication medium that carries LonTalk packets, as defined by the ANSI/EIA/CEA-709.1 standard. When attach to a LONWORKS channel, the LNS Server computer or the computer running the LonMaker tool (*LonMaker computer*) must contain an LNS network interface, which is used to communicate with the physical network.

IP is an acronym for Internet Protocol. IP is part of TCP/IP (Transmission Control Protocol/Internet Protocol) protocol suite, the basic programming foundation that carries computer messages around the globe on the Internet and across many Local Area Networks (LANs) and Wide Area Networks (WANs)

A LONWORKS/IP channel is a communication medium that carries IP packets containing LonTalk packets. When attached to a LONWORKS/IP channel, the LNS Server computer and the LonMaker computer must contain an IP network interface, (such as an Ethernet network interface card or a modem with IP point-to-point protocol [PPP] software) that is used to communicate with the physical network.

An LNS/IP channel is a communication medium that carries IP packets containing LNS packets. An LNS/IP channel is only used for communication between an LNS Serve and remote lightweight LNS clients.

The LNS Server computer and the LonMaker computer may be on separate channels.

LonMaker Client Types

The LonMaker *client type* determines the location of the LonMaker tool in relation to the LNS server. The LonMaker tool has the following three client types:

- *Local Client*
- *Remote Full Client*

- *Remote Lightweight Client*

Local Client means the LonMaker tool is running on the same computer as the LNS Server.

Remote Full Client indicates the LonMaker tool is running on a different computer than the LNS Server and communicates with the LNS Server over LONWORKS or LONWORKS/IP channels.

Remote Lightweight Client indicates the LonMaker tool is running on a different computer than the LNS Server and communicates with the LNS Server over an LNS/IP channel.

More details are provided in the *Using the LonMaker Tool Remotely*.

Visio Basics

The LonMaker tool is built on the Visio 2002 drawing tool to provide a robust technical drawing environment for network design. A LonMaker drawing consists of one or more drawing files, each containing multiple subsystems, each on one Visio page. See the Visio documentation for a detailed description of Visio commands and capabilities. This section describes several key Visio concepts and functions that are integral to the use of the LonMaker tool.

Two key Visio concepts are *shapes* and *stencils*. Shapes are reusable drawing objects. A shape may represent a simple drawing object such as a line, arc, circle, or square. A shape may represent a complex drawing object with special behavior such as a LonMaker Device shape or Functional Block shape.

To simplify finding and reusing shapes, Visio defines a special type of drawing called a *stencil*. Stencils contain shapes that may be reused in your drawings. A shape contained on a stencil is called a *master shape*. When you drag a master shape from a stencil to one of your drawing pages, Visio automatically makes a copy of the master shape on your drawing and leaves the master shape unchanged on the stencil.

To open a stencil, click Visio `Open Stencil` and select a stencil. The *LonMaker Basic Stencil* contains shapes for all the basic components of a LONWORKS network (see *LonMaker Stencils* for more information on this and other stencils). When you drag a shape to a drawing, the LonMaker tool creates an instance of the network component represented by that shape and prompts you for information about that component.

Custom master shapes and stencils may be created for any set of devices and functional blocks. For example, the LonMaker tool includes custom master shapes and a custom stencil for LonPoint devices and functional blocks. You may wish to create your own custom master shapes and stencils to speed up network design. See *Creating Custom LonMaker Master Shapes* and *Creating a Custom LonMaker Stencil* for more information.

To simplify access to your most commonly used stencils and drawing options, Visio defines another type of drawing called a *template*. Templates are drawings that may be used as the starting point when you create a new drawing. The LonMaker tool includes a LONWORKS template that is used automatically when you create a LonMaker drawing. If you wish, you can create your own custom LonMaker template and select it as the default template in the `Options` tab of the *LonMaker Design Manager*.

2

Getting Started

Provides information on hardware requirements, installation of the various LonMaker tool components, a quick-start tutorial, the LonMaker Design Manager, creating and opening a LonMaker network design, using the LonMaker tool remotely, and backing up and restoring LonMaker Networks.

What's Included with this Release

This release includes the following:

- *LonMaker CD*. This CD includes the LonMaker software with LNS Server, LonPoint Plug-In and Applications, Microsoft Visio Professional or Standard 2002, LNS drivers, and Adobe Acrobat Reader. An integrated installation program simplifies installation of all the component software.
- *Registration Card*. Return this card to register your copy of the LonMaker tool. You must register your software to be eligible for support, updates, and discounts on upgrades. You can also register on-line at www.echelon.com/register.html.
- *LonMaker User's Guide*. Start here to learn how to install and use the LonMaker tool. Additional documentation is included in the on-line help files installed with the LonMaker tool. Updated documentation may be available at www.echelon.com/lonmaker.

Hardware Requirements

Hardware requirements and recommendations for the computer on which the LonMaker Integration Tool will run are given below. If you are engineering a large network with 200 to tens of thousands of devices, see the additional recommendations for the LNS Server and for the computer running the LonMaker tool in *Enhancements for Larger Networks*.

Smaller Networks

The LonMaker Integration Tool requires a personal computer that meets the following requirements:

- Microsoft Windows XP, Windows 2000, or Windows 98; Windows XP or Windows 2000 recommended
- Pentium 200 MHz or faster (Pentium II 350 or better recommended)
- 350 megabytes (MB) free hard-disk space
- 128-MB RAM minimum
- CD-ROM drive
- Super VGA ((800 × 600) or higher-resolution display with 256 colors
- Mouse or compatible pointing device

The memory required is affected by the number of plug-ins, LNS applications, and other Windows applications that are running simultaneously. More than 128 MB may be required if you are running multiple plug-ins or applications.

A 100 MB or larger removable storage media drive, such as a Zip disk or a remote file server, is recommended for saving LonMaker backup files.

Enhancements for Larger Networks

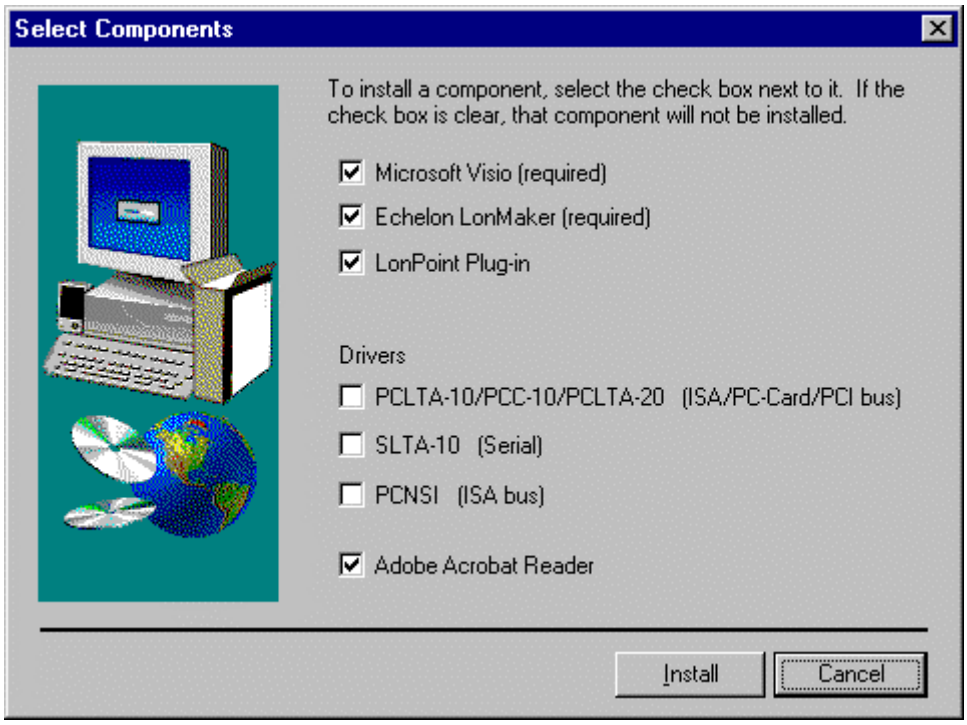
High-performance hardware is essential when engineering large networks. The disk for the LNS Server should have a sustained transfer rate greater than a 20 MB per second with less than an 8 milliseconds (ms) average seek time. This transfer rate can be met with an IDE drive using an UltraDMA/33 or faster interface, or with a SCSI drive using a Fast Wide SCSI, Fast-20 SCSI, Ultra SCSI, or faster interface. You can further increase performance and reliability by using a redundant striped disk configuration such as a RAID 5 disk array.

For large networks, the computer for the LonMaker tool should be at least a 500MHz Pentium III running Windows XP or Windows 2000 with at least 256 MB of memory. You may need to increase your virtual memory also. The speed, operating system, and memory size is not as important for commissioning the network; therefore, a Windows 98 laptop with at least 128MB RAM will work fine for commissioning devices. A Windows 98 laptop is useful for commissioning since the LonManager™ Protocol Analyzer, a tool very useful during commissioning, is not available on Windows XP or Windows 2000.

Installing the LonMaker Integration Tool

Each licensed copy of the LonMaker tool allows up to two installations, typically a primary installation on a desktop computer and a secondary copy on a laptop computer. The secondary copy must be for the exclusive use of the individual who is the primary LonMaker user on the primary computer; the LonMaker software may only be used on one computer at a time; and the secondary computer cannot be used to commission or recover LONWORKS devices. See the LonMaker license in Appendix C for additional restrictions. To begin your installation, follow these steps:

1. If you previously installed a LonMaker Trial Edition and you are now installing one of the full editions, you must first uninstall the Visio Trial software. If you do not uninstall the Visio Trial software first, the LonMaker software will be installed, but the full version of Visio will not.
2. If are installing the LonMaker Trial Edition and you already have the retail version of either the LonMaker Integration Tool or Microsoft Visio 2002, uninstall them and restart your computer before installing the LonMaker Trial Edition.
3. Close all running Windows applications. If you are running any 16-bit applications (including background applications), the LonMaker software may not install properly.
4. If you are running Windows XP or Windows 2000, disable any LONWORKS services.
5. Insert the LonMaker CD into your CD-ROM drive.
6. If the LonMaker setup application does not launch immediately, open the Windows Start menu and select `Run`. Browse to the LMWSetup application on the LonMaker CD and click `Open`. The LonMaker Setup window appears.



7. Select the components that you wish to install by setting the appropriate checkboxes on the Select Components window.

   Visio: If you have an existing installation of Visio, you must still install Visio from the LonMaker CD to use the LonMaker tool. Visio optionally uses Microsoft Internet Explorer 5.0 or later; so if this program is not already installed, you will be asked to install it during installation. Internet Explorer is not required for the LonMaker tool.

   LonMaker Integration Tool: The LonMaker tool and the plug-ins must be the same version. If you reinstall a newer version of the LonMaker software, you must reinstall the newer version of the plug-ins.

   Drivers: When used on LONWORKS channels, the LonMaker tool requires the use of an LNS network interface such as an i.LON 10, i.LON 100, PCLTA-10, PCLTA-20, PCC-10, PCNSI, SLTA-10, or PL-SLTA. When used on LONWORKS/IP or LNS/IP channels, the LonMaker tool requires any IP network interface (such as Ethernet) card or modem with PPP software. An IP interface is also required if you are using an i.LON 10 or i.LON 100 Internet Server as a remote network interface. Older network interfaces, such as the PCNSS and SLTA/2, are not LNS-compatible.

   If you are using a PCLTA-10, PCLTA-20, or PCC-10, set the PCLTA- 10/PCC- 10/PCLTA-20 checkbox. If you are using a PCNSI, set the **PCNSI** checkbox. If you are using an SLTA-10, set the **SLTA-10** checkbox. If you are using an IP network interface, do not select any of the LNS network drivers.

   If you are using another LNS or IP network interface, install the network interface hardware and driver following the instructions provided with the hardware. Most network interfaces include a Windows Control Panel application that handles network interface configuration. You must perform this configuration before you can use the LonMaker tool attached to a network. These control panels handle host details such as IRQ assignment and also manage network parameters such as buffer counts and transceiver types.

   Adobe Acrobat Reader: Adobe Acrobat Reader is a free program that allows you to read Adobe Acrobat files (.pdf extension). An Acrobat version of a preliminary version of this

manual is included on the LonMaker CD (the final versoin of this manual, or a newer version, is available at www.echelon.com/lonmaker). Many of the LONMARK reference documents are exclusively in Acrobat format; and, therefore, they require Acrobat.

To install Adobe Acrobat Reader, ensure the `Adobe Acrobat Reader` checkbox is selected.

Click **Install**. The installation program installs the selected components sequentially, prompting you for required reboots.

8. If you are installing the LonMaker Trial Edition, you must activate Visio before you can use the LonMaker tool. To activate Visio, open the Windows **Start** menu and click **Microsoft Visio**. The Office Activation Wizard automatically appears. Follow the instructions to activate your copy of Visio. You must have an Internet connection to activate Visio. See the Microsoft READ THIS FIRST card included with you LonMaker Trial Edition CD for more information on activating Visio.

Installing Visio

1. If you selected the Visio component in the Select Components window, The Microsoft Visio setup wizard appears when you click **Install**. Before beginning the installation, Visio 2002 may install a system update, and will reset the computer before continuing the Visio 2002 installation.
2. Follow the instructions in the installation program to complete the Visio setup. You will be asked to enter a Product ID if you have not previously installed Visio 2002. If you are installing the LonMaker Professional or Standard Edition, enter the Product ID shown on the back of your LonMaker CD case. If there are two serial numbers on the back of your CD case, the top two lines are the Visio product ID. If you are installing the LonMaker Trial Edition, enter the Product Key on the back of the Microsoft READ THIS FIRST card included with your LonMaker Trial Edition CD. See your Visio documentation for more information on the Visio installation process.

   The Visio installation may suggest that you exit LonMaker setup. You can safely disregard this message by clicking `Ignore`.

   If you want to keep an existing Visio installation, install the Visio program on the LonMaker CD into a new directory.

Caution *When you have multiple versions of Visio installed, the LonMaker tool uses the last Visio program that you used. Therefore, if you use a Visio version other than the one supplied on the LonMaker CD, you must start and exit the LonMaker-supplied Visio program before you start the LonMaker tool.*

If you do not have Microsoft Internet Explorer 5.0 or higher installed on your computer, you will be asked to install it while Visio is being installed. This is only necessary if you plan to use Visio's Facilities Management Solution, which displays information in HTML format (see the Visio documentation for more information). Internet Explorer is not necessary for any LonMaker functionality.

Once Visio installation is complete, LonMaker installation automatically begins as described in *Installing the LonMaker Tool*.

Installing the LonMaker Tool

1. The LonMaker setup program begins automatically. Read the information on the Welcome window and click **Next**. The Software Licensing Agreement window appears.
2. Read the agreement and click **Yes** if you agree with the terms of the agreement. The Registration window appears.

3. Enter your name, company name, and the LonMaker serial number in the appropriate fields. If you did not license an upgrade version, the serial number is located on the back of your LonMaker CD case. If there are two serial numbers on the back of your CD case, the second number (on the third line) is the LonMaker serial number. Save this number. If you licensed an upgrade version, your serial number is located on the back of your original LonMaker CD case. It will be automatically displayed if you install your upgrade on the same computer as your original LonMaker software. If you are installing on a different computer, you must find the serial number that you saved from your original version of the LonMaker tool. Click **Next**. The Select Destination Directory window appears.
4. Choose a LonWorks folder in which you want the LonMaker software installed. The LonMaker software will be installed in a LonMaker folder below the LonWorks folder that you specify. If you installed other LONWORKS software on this computer, use the same LonWorks folder. The default folder is `C:\LonWorks`. If you previously installed other LONWORKS software on this computer, the last LonWorks folder that you selected will be displayed as the default, and you should not change this value. Click `Next`. The Select Program Folder window appears.
5. Choose a program folder for the LonMaker software. This folder is added to the Program folder of your Windows **Start** menu. The default is `Echelon LonMaker for Windows`. Click **Next** and the installation program installs the software.
6. A window appears which asks you if you want to view the Readme file. Select **Yes** and click **`Finish`**. The Readme file appears.
7. When you finish reading the Readme file, close the window.

Caution *When you install the LonMaker tool, you may get a "Your license has expired" error if the LonMaker software was previously installed on the same computer and subsequently uninstalled. Add LonMaker credits as described in Chapter 8 to update your license.*

Installing the LonPoint Applications, Plug-in, and Utilities

If you set the LonPoint Plug-in checkbox in the Select Components dialog, the LonPoint installation program automatically starts following the LonMaker installation. The LonPoint Installation window appears. Complete the following steps:

1. Read the information on the Welcome dialog, and click **Next**. A license agreement dialog appears.
2. Click **Yes** if you agree with the terms of the agreement. The Registration window appears.
3. Enter your name and company name, and click **Next**. The Choose Destination Directory window appears.
4. Choose a LONWORKS folder for the plug-in. You must use the same LONWORKS folder in which you installed the LonMaker tool. The default is `C:\LonWorks`. Click **Next**. The Select Echelon Application Image Version window appears.
5. If this is a new installation, use LonPoint firmware version 3 instead of version 2. This window allows you to install a copy of version 2 firmware if you need the capability to install devices with this older firmware. Do not select the option to install Application Image Version 2 files unless you intend to install version 2 devices in new networks instead of upgrading to version 3. See the LonPoint Application and Plug-in help file for more information. Click **Next**. The select Program Folder window appears.

6. Select an existing LONWORKS program folder or type in the name of a new one. The default program folder name is Echelon LonPoint Software. Click **Next**.
7. The LonPoint applications, plug-in, and utilities install on your computer. View the Readme file when prompted to do so, and then click **Finish**.

Installing Network Drivers

If you are using an *i*.LON 10 or *i*.LON 100 as a network interface, configure the xDriver software as described in the manuals for those devices. If you are using a PCC-10, PCLTA-10, or PCLTA-20 LONWORKS network interface, install the appropriate drivers as described below:

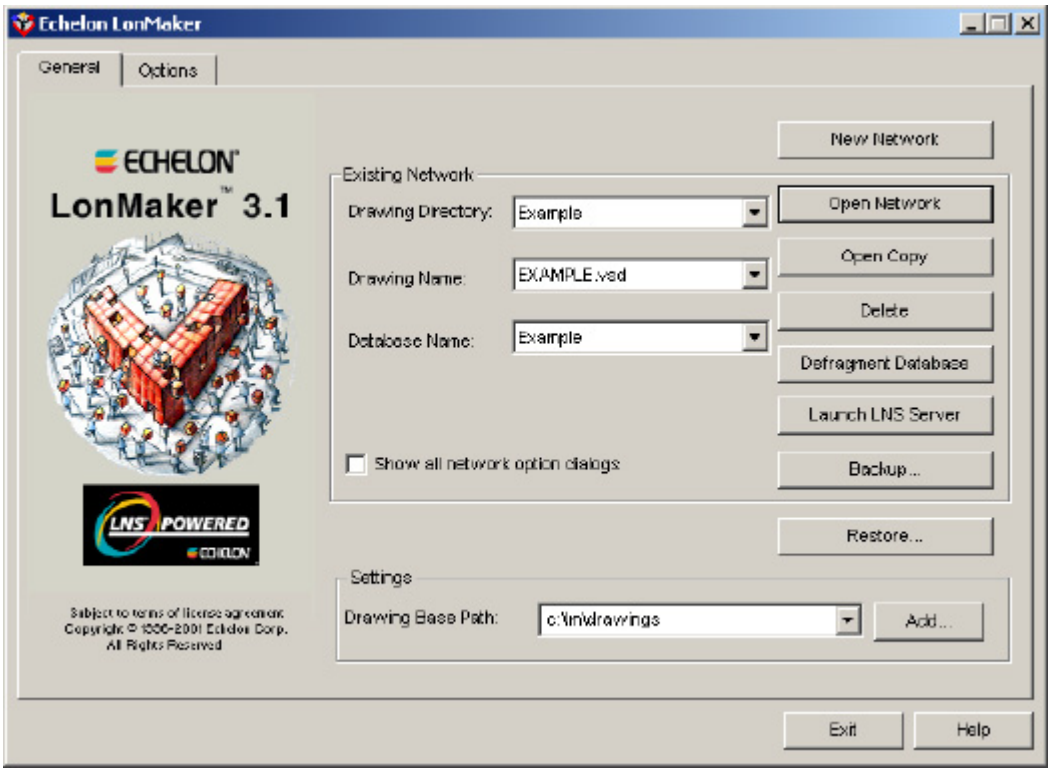
1. The LonMaker installation program automatically starts the appropriate installation program. See the installation instructions in the *LonMaker User's Guide* appendices for details. Be sure to install the driver software before you install the network interface hardware.
2. Configure the network driver you installed. (See the configuration procedure for your driver in Appendix B for instructions.)

Installing Adobe Acrobat Reader

If you set the Adobe Acrobat Reader checkbox in the Select Components dialog, the Adobe Acrobat Reader setup program begins automatically. Follow the instructions in the setup program to complete your Adobe Acrobat Reader installation.

LonMaker Design Manager Overview

The LonMaker Design Manager allows you to create, open, backup, restore, defragment, and delete LonMaker networks. You can also set the resource file languages and select the LonMaker template for new networks. To open the LonMaker Design Manager, click the Windows **Start** menu, point to **Programs**, then point to the **Echelon LonMaker for Windows** folder, and select **LonMaker for Windows**. The LonMaker Design Manager appears:



The LonMaker Design Manager `General` tab contains the following fields and buttons:

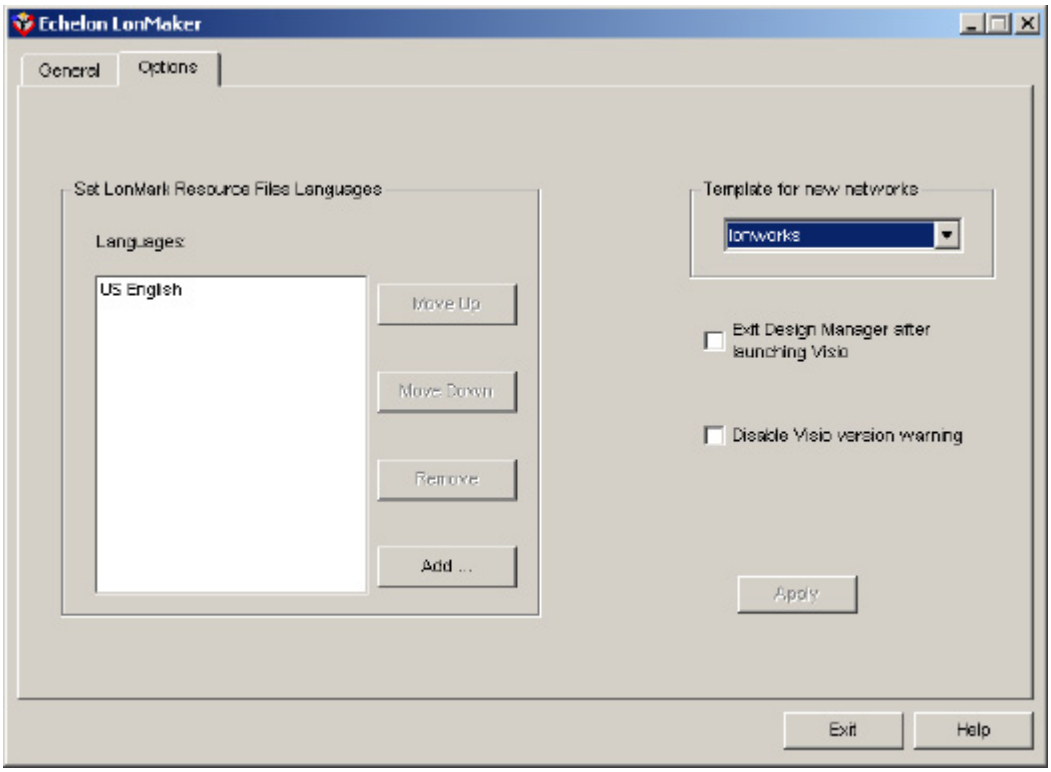
Drawing Directory	Selects a directory from all the subdirectories of the directory indicated in `Drawing Base Path`. To work with an existing LonMaker network design, select the directory containing the design.
Drawing Name	Selects a LonMaker drawing from all the LonMaker drawings contained in the selected drawing directory. Select the LonMaker drawing you want to open, delete, or backup.
Database Name	Selects an LNS database from all the LNS network databases on this computer. Select the database you want to defragment, delete, or backup, or for which you want to start the LNS Server. This field is not used for the Open Network, Open Copy, and Restore operations.
Show all network option dialogs	If selected, all of the network option windows will be presented as the network is opened regardless of whether the **Skip this Prompt** option had been previously selected.
New Network	Creates and opens a new LonMaker network design consisting of a new LNS database and a new LonMaker drawing. See *Creating a LonMaker Network* for details.
Open Network	Opens the LonMaker drawing and associated LNS network database specified by the LonMaker drawing selected in the `Drawing Name` field. The **Database Name** field is ignored by this operation. See *Opening an Existing LonMaker Network* for details.
Open Copy	Opens a copy of the LonMaker drawing specified in the

	`Drawing Name` field, making a copy of the network drawings and the associated LNS network database. This copy is created like a new network. (You will be prompted to choose a new top-level drawing name and database path. The `Database Name` field is ignored by this operation. See *Opening a Copy of an Existing LonMaker Network* for details).
Delete	Deletes the LonMaker drawing specified in the `Drawing Name` field and the LNS network database specified in **Database Name**. To delete only one, specify <none> in the field you wish to keep.
Defragment Database	Defragments and recreates the index for the LonMaker database specified in **Database Name**. This can reduce the size of and decrease the access time to a LonMaker database that has grown in size due to many changes. Backup the database before defragmenting it in case of an error while defragmenting.
Launch LNS Server	Starts the LNS Server so that remote client computers can access the LNS network database. See *Using the LonMaker Tool Remotely* for more information.
Backup	Backs up the LonMaker drawing specified in the `Drawing Name` field and the LNS network database specified in **Database Name**. See *Backing Up a LonMaker Network* for more information.
Restore	Restores a LonMaker drawing and LNS network database from a LonMaker backup file. See *Restoring a LonMaker Network* for more information.
Drawing Base Path	Determines the directory that will be used by the **Drawing Directory** list. All of the subdirectories in this directory will be listed in the **Drawing Directory** list. You may type in a new pathname or select one using the **Browse** button.
Exit	Closes the LonMaker Design Manager. This does not close Visio or any open networks. To automatically exit the Design Manager after opening a LonMaker drawing, click the `Options` tab and select the **Exit Design Manager After Launching Visio** checkbox.

The LonMaker Design Manager's Options tab (shown below) allows you to set a prioritized list of languages for LONMARK resource files and select the LonMaker template for new networks.

When the LonMaker tool displays documentation for selected devices, functional blocks, and network variables, it uses the definitions contained in LONMARK resource files. You can display the LONMARK resource file information in different languages by specifying a prioritized list of languages for LONMARK resource files in the LonMaker tool.

You can set the resource file language for a specific network while in the LonMaker tool by selecting the Resource File Language tab in *Network Properties* for that network. To set the resource file language globally for new networks, select the `Options` tab in the LonMaker Design Manager:



The LonMaker Design Manager's `Options` tab contains the following fields and buttons:

Set LONMARK Resource Files Languages	Allows available language-specific LONMARK resource files to be added, removed, or reordered in the languages list. When searching for a definition, the LonMaker tool searches the first language file in the list for the device information, then the second language file in the list, and so on, until it finds the information for the specified device. If no match is found and the device information is found in the corresponding U.S. English file, the English text will be used to display the information. U.S. English is the default language and cannot be removed from the list. The language-specific LONMARK resource files added to the list must be installed and available to the LonMaker tool. Usually they will have been installed if available and you click **`Add`** to add them to the list. If you do not see language resource files you expected to see when you click **Add**, you can install them. To install those resource files, click **`Start`**, highlight Echelon LNS Utilities, select the **LNS Resource File Utility**, and follow the prompts.
Languages	Lists the languages in the order they will be searched for device information.
Move Up	Moves the selected language up one position in the list.
Move Down	Moves the selected language down one position in the

	list.
Remove	Removes the selected language from the list.
Add	Adds a language to the end of the list.
Template for New Networks	Specifies the LonMaker template for subsequent new networks that you create. The template is an empty LonMaker drawing that specifies a default drawing background, styles, stencils, and other LonMaker settings. The list contains the available LonMaker templates. The default templates are the following: **LONWORKS** – the initial default template used for new networks. It uses U.S. measurement units. **LONDemo** – the template used to create a demonstration network (number of devices is limited to six and LonMaker credits are not used when commissioning devices). **LONWORKSMetric** – a template that uses metric measurement units for drawing pages. Any custom LonMaker templates installed in the template directory also appear in the list.
Exit Design Manager after Launching Visio	Selecting this option automatically closes the LonMaker Design Manager after launching Visio.
Apply	Saves the changes that you make in this window. The Apply button is enabled only when an option has been changed.

LonMaker Quick Start Tutorial

This section shows you how to quickly create a fully functioning control network using the LonMaker tool and the LonPoint Plug-in. The LonPoint Plug-in, included with the LonMaker tool, provides LonPoint-specific user interfaces for configuring properties on LonPoint devices. The *LonPoint Plug-in must be installed* on your computer for this quick-start exercise, but you do not have to any physical devices.

In this quick-start exercise, you will configure the following two LonPoint I/O devices and their associated functional blocks to build a network that measures and controls temperature in a system:

- Analog input device that monitors the temperature of a system by measuring the resistance of a thermistor
- Digital output device that controls an exhaust fan

Using these devices and their associated functional blocks that represent a temperature sensor and a thermostat, you will define the analog control to start the exhaust fan if the temperature exceeds a certain set point, as shown in the following figure. This example is an operation commonly required in many control systems, and the LonMaker tool simplifies this capability with its network design and installation features.

To create the quick-start example network, you may provide the following devices. If you do not have the optional items listed below, you can still design this network in engineering mode by following the steps without commissioning the devices in step 2 or monitoring the devices in step 7.

- 1 - Computer with the LonMaker software installed
- 1 - LNS or IP Network Interface (optional)
- 1 - LonPoint Analog Input Device (optional)
- 1 - LonPoint Digital Output Device (optional)
- 1 – *i*.LON 1000 Internet Server (optional; required only if an IP network interface is used for the network connection)

If you plan on working with a live network, you must define and configure your network interface before you start the LonMaker portion of the Quick Start. If you are using an LNS network interface such as the i.LON 10, i.LON 100, PCC-10, PCLTA-10, PCLTA-20, PCNSI, SLTA-10, or PL-SLTA, install the network interface hardware and configure the network driver as described in the documentation for the network interface. This documentation is available in an Echelon i.LON 10, Echelon i.LON 100, or Echelon Drivers program folder on you Windows Start menu (point to Programs, then select the appropriate Echelon folder). If you are using an i.LON 1000 server, follow these steps to set-up your LonWorks/IP interface and create your LonWorks/IP channel:

1. Ensure that all of you have static IP addresses for your LonMaker computer and i.LON 1000 server. A static IP address is an address that is not dynamically assigned by a DHCP server. If you need clarification on your IP addresses, see you information systems representative. They can assign you the required static IP addresses for your LONWORKS/IP devices.
2. Create a LONWORKS/IP interface on your LonMaker computer. To create a LONWORKS/IP interface, follow these steps:

   a. Open the Windows Start menu, point to *Settings*, then choose Control Panel. The Windows control panel opens.

   b. Double-click the *LNS IP Configuration* control panel application in the Windows control panel.

   c. Click **Add**. The Add an IP Device dialog opens.

   d. Enter a unique name for the LonMaker computer and verify that the displayed IP address is correct.

   e. Click **OK**. The Add an IP Device dialog closes.

   f. Click **OK**. the LNS IP Configuration control panel application closes.

   See the LNS IP Configuration control panel application help file for more information.
3. Define the LONWORKS/IP channel and devices in the i.LON Configuration Server. To do this, follow these steps:

   a. Open the Windows Start menu, point to **Programs**, then point to **Echelon i.LON**, then choose **i.LON Configuration Server**.

   b. Open the Channel menu and select New Channel. Enter a name for the new LONWORKS/IP channel.

   c. Right-click the channel you just created and select New Device from the shortcut menu. Enter a name for your LonMaker computer device on the LONWORKS/IP channel.

   d. Right-click the new device and select Device Properties from the shortcut menu. Enter the IP address for the device.

   e. Repeat steps c and d for the i.LON server.

The LonMaker computer will not be fully commissioned on the LONWORKS/IP channel until you run the LonMaker tool. For more information, see the i.LON Configuration Server Help file or the i.LON Configuration Server User's Guide.

LonMaker credits are required to commission devices (free credits are provided with the LonMaker tool; additional free credits are available for training purposes). You can also decommission the devices after you complete the Quick-Start exercise, and the LonMaker tool will return the credits.

Creating the quick-start network in the figure shown below takes approximately 20 minutes to complete and includes the following steps:

1. Create a new LonMaker network
2. If you are using an *i*.LON 1000 Internet Server, define and commission it.
3. Define and commission the LonPoint devices
4. Assign functional blocks to the LonPoint devices
5. Connect the functional blocks
6. Configure the temperature input/output of the analog input functional block
7. Configure the analog functional block
8. Verify operation

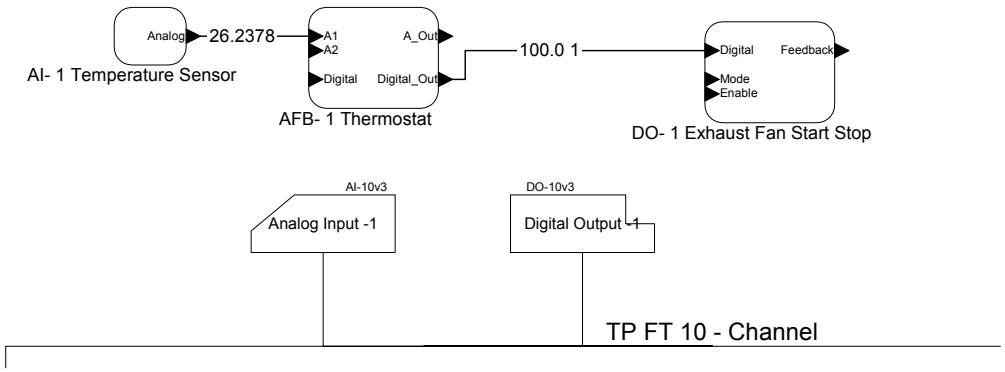


Figure 1 Quick-Start Example Network

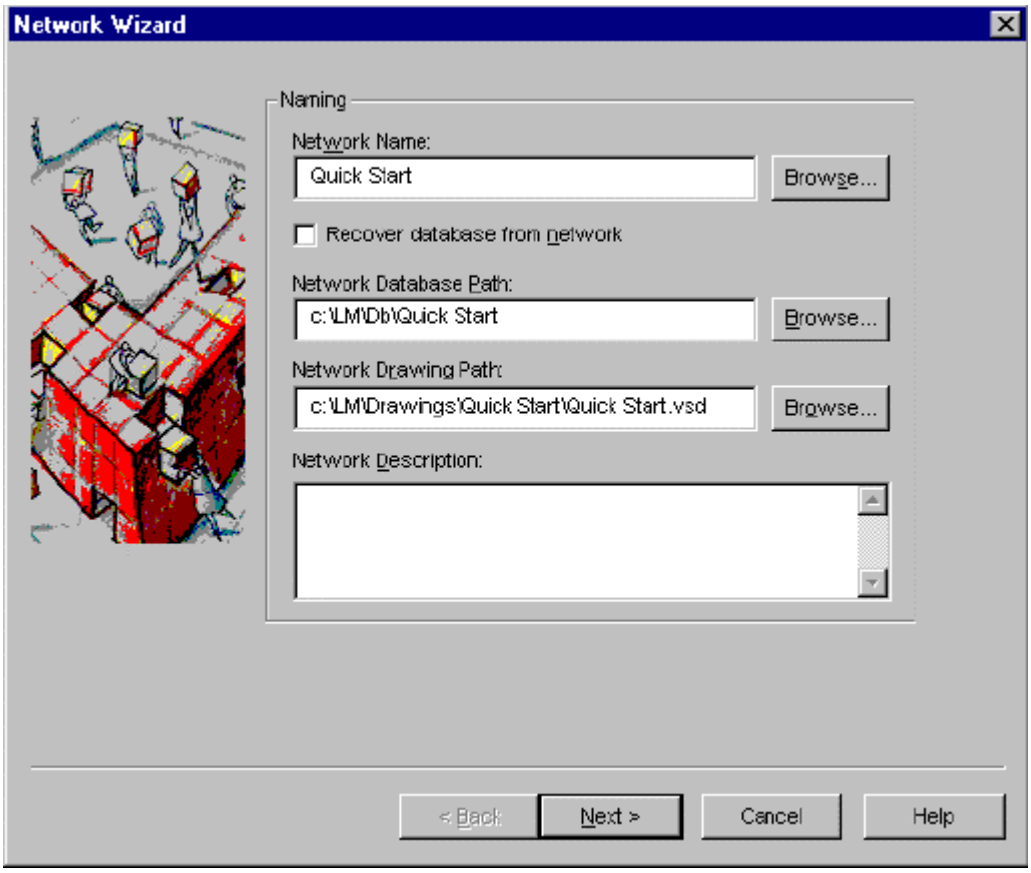
Note: The quick-start example provides the most basic method to create a network design and is a good introduction to the LonMaker tool. However, depending on your situation, you may use other methods provided by the LonMaker tool that will save you time, particularly with large networks. For example, the LonMaker tool can:

- Create a LonMaker network design, both a database and a drawing, by recovering an existing network
- Create a LonMaker drawing from an existing database, if the network was created with an LNS tool
- Find devices to commission on a physical network using the *Discover Devices* command (see Chapter 5, *Installing Networks*)
- Read information from *barcode readers* to identify devices (see Chapter 5, *Installing Networks*)

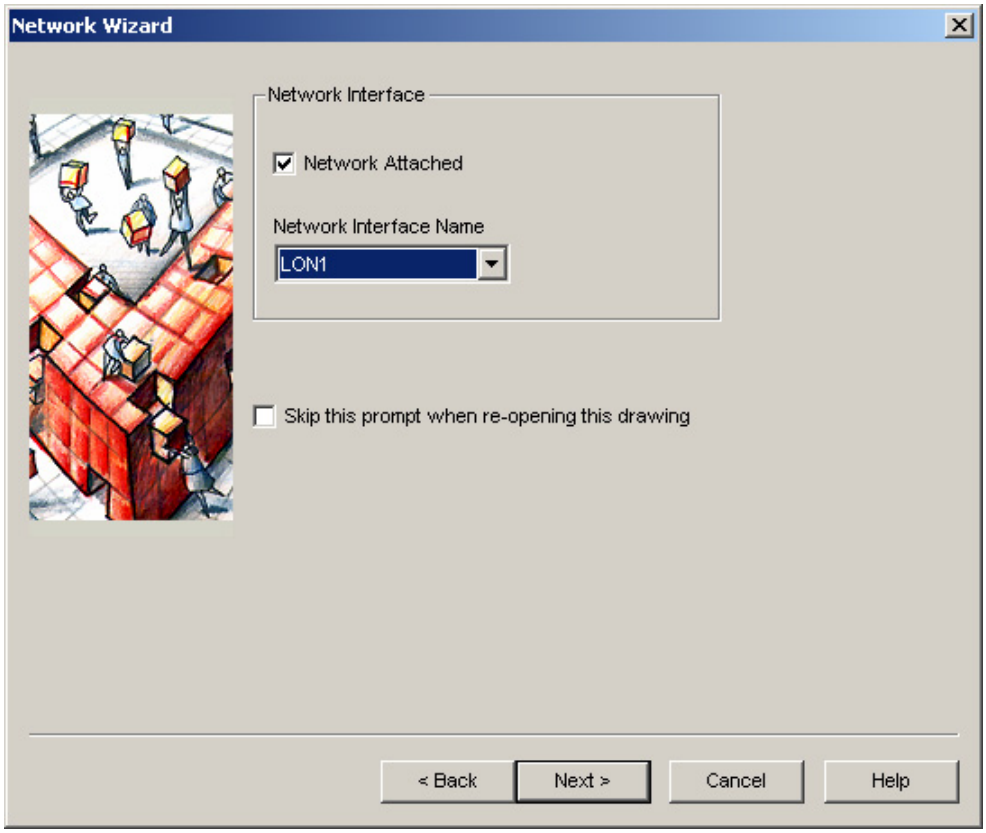
Specifics on how to use these methods and others will be provided as you learn to use the LonMaker tool. For now, create the quick-start example network and begin to experience the ease and power built into the LonMaker tool.

To create the quick-start example network, select `LonMaker for Windows` from the Windows `Start` menu and follow these steps:

1. **Create a New LonMaker Network Design**. A *LonMaker network design* consists of a LonMaker drawing and an LNS network database. To *create* a new LonMaker network design, click **New Network** on the *LonMaker Design Manager* `General` tab. Visio starts and the New Network Wizard initializes. The Naming window of the Network Wizard appears.



Enter a unique network name and click **Next**. The Network Interface window appears.



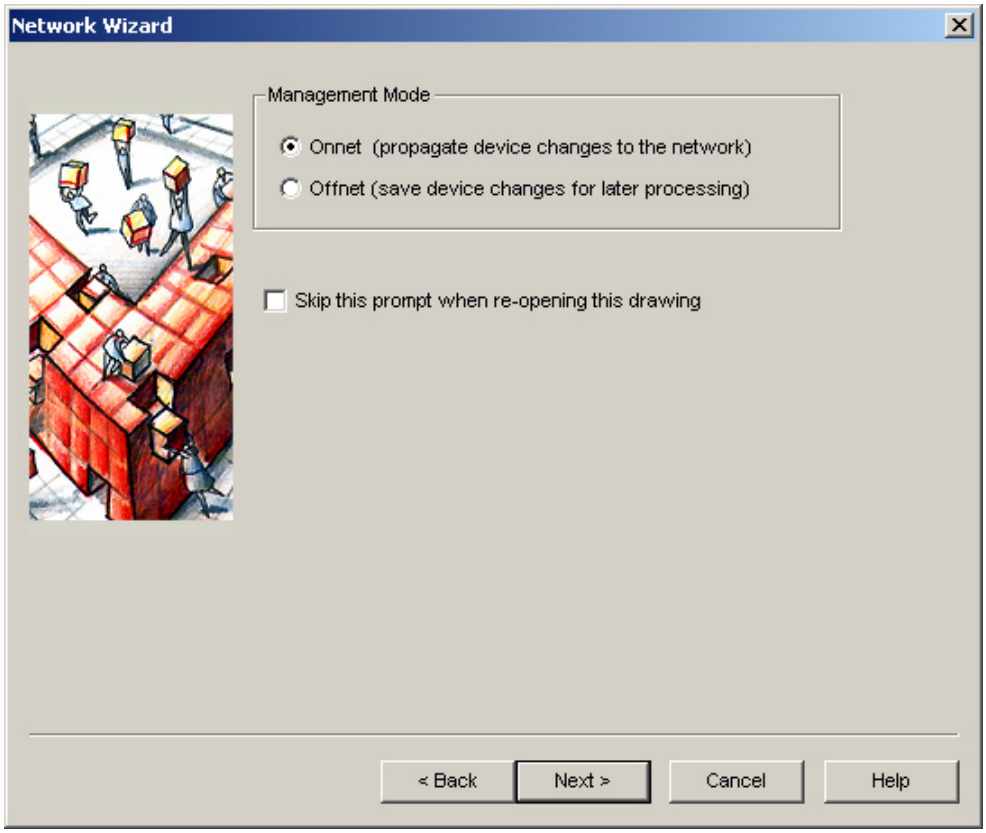
If you are connected to a network with the required physical devices, set **Network Attached**, and then enter a network interface name in **Network Interface Name**.

If you are not connected to a network with the required physical devices, leave the checkbox clear.

Click **Next**.

If you are not connected to a network, the Plug-in Registration window appears. Skip the following description of the Management Mode window and proceed to the Plug-in Registration window.

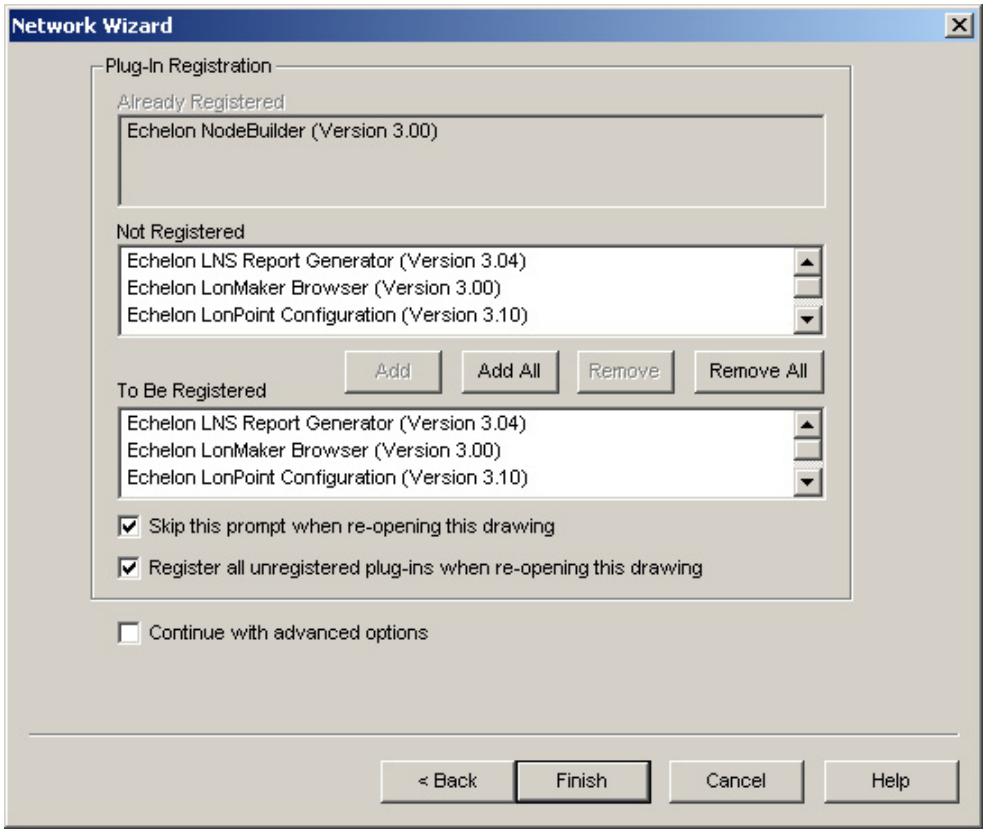
If you selected a network interface, the management mode window appears.



You have the following two choices:

- `OnNet`– Any changes that you make are propagated across the network immediately (after devices have been commissioned or functional blocks added, connected, or configured).
- `OffNet`—Changes to application and network *configuration properties* are saved in the LNS database and propagated across the network when you next go `OnNet`. After you have been OnNet once, network variables, such as temperature or enable/disable, can be changed on the network while working in OffNet mode (after devices have been commissioned and functional blocks added, connected, and configured). See Appendix D, *Glossary* or Chapter 1, *Introduction* for more information on configuration properties and network variables.

Select **OnNet** and then click **Next**. The Plug-In Registration window appears.



Register all plug-ins and then click **Finish**. The LonMaker main window appears.

Open the **LonMaker** menu and select **Network Properties**. Select the `LonMaker Options` tab. Select `Functional Blocks` for the Optional Category. Set **Include Device Name in Default FB Name**.

2. **Define and Commission the LonPoint Devices**. A *device*, represented in the LonMaker drawing by a device shape, corresponds to a physical device on the network. A device is defined in the LonMaker tool by dragging a Device shape from a stencil to the drawing, and entering the relevant information when prompted by the Device Wizard. All LonPoint Device shapes are available on the LonPoint Shapes 3.0 *stencil* on the left side of the Visio window (if the stencil is minimized, click its title bar to display it). When a device is commissioned, the device shape is associated with the physical device on the network.

   To define and commission the two LonPoint devices, drop an Analog Input Device shape

from the LonPoint stencil to the drawing as shown in the following diagram. Select a Digital Output Device shape

and drag it to the drawing. When prompted, enter the device name, set **Commission Device**, and then click **Next**. If you do not have the physical devices, clear **Commission Device**. Accept the default values on the next four windows. Configure the device state as `Online` and click **Finish**. When prompted, push the service pin to install the device.

Optionally, assign a descriptive name for the channel as in the following diagram. To change the channel name, right-click the channel shape, and then click **Properties** on the shortcut menu, and enter the new channel name in the `Name` field of the Channel Properties dialog.

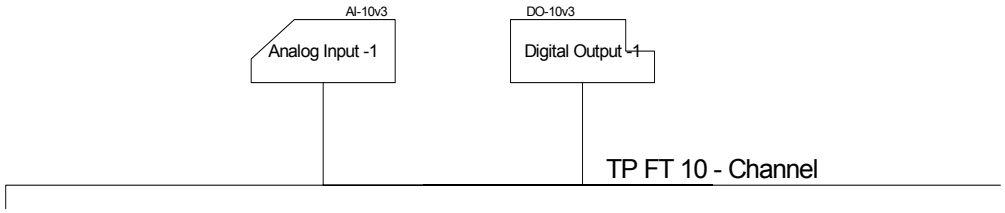


Figure 2 Quick-Start Example Channel

3. **Assign Functional Blocks to the LonPoint Devices**. A *functional block* represents a collection of network variables and configuration properties on a device that perform a related function. The quick-start network uses three functional blocks to represent the functions needed to control the room temperature.

   Drag the following functional blocks to the drawing:

   When prompted, assign the `Analog Input` and `Analog Fn Block` to the Analog Input device, and the `Digital Output` to the Digital Output device. Enter a descriptive name for each functional block, as shown in Figure 1 above (for example, Temperature Sensor, Thermostat, and Exhaust Fan Start Stop).

   Click **Finish**.

4. **Connect the Functional Blocks**. A *connection* allows two or more functional blocks to share information using a network variable (of the same type) on each block. The functional blocks in the quick-start network are connected to send the temperature sensor's network variable value to the thermostat and, in turn, to send a network variable value to the device controlling the fan.

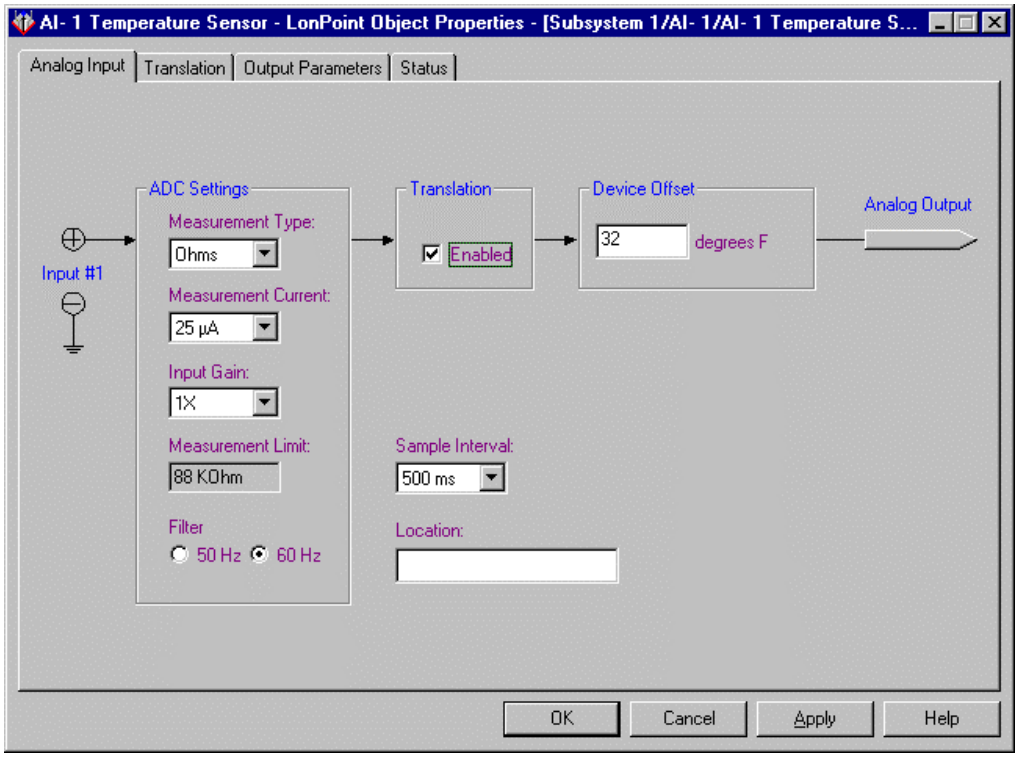
   To connect the functional block representing the temperature sensor to the functional block representing the thermostat, drag a Connection shape to the drawing. Position one end of the connection on top of the Analog network variable on the AI-1 Temperature Sensor functional block. A small red box appears when you have correctly placed the connection point on the network variable. Position the other end to the A1 network variable on the AFB-1 Thermostat functional block.

   Drag a Connection shape to the drawing to connect the functional block representing the thermostat to the functional block representing the fan. Connect the Digital_Out network variable on the AFB-1 Thermostat functional block to the Digital input network variable on the DO-1 Exhaust Fan Start Stop functional block. Refer to Figure 1.

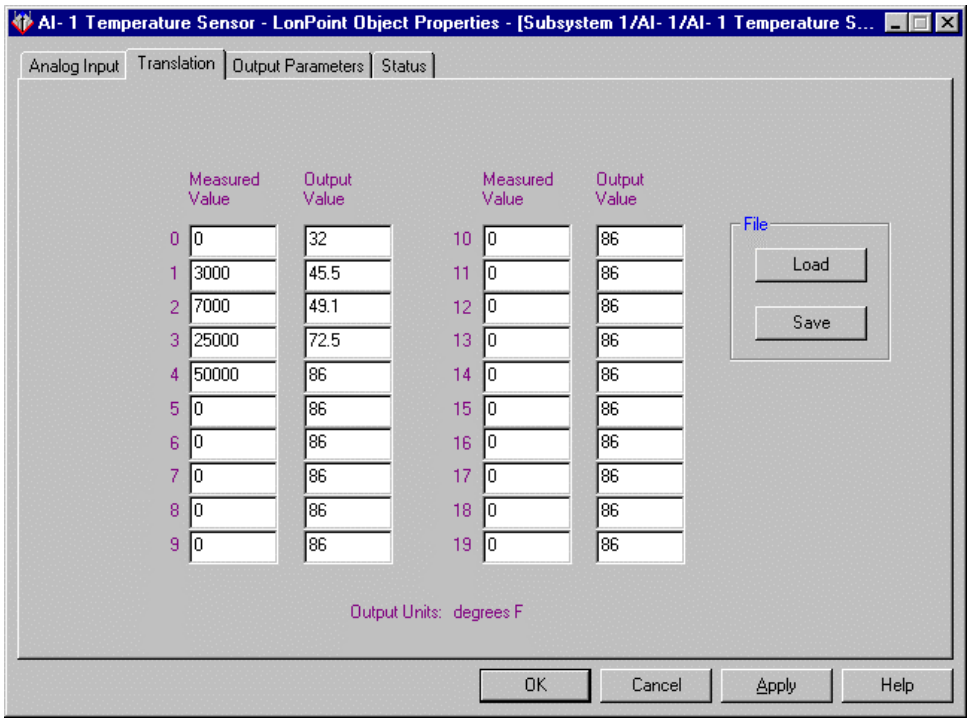
5. **Configure the Temperature Input/Output of the Analog Input Functional Block**. This step uses a translation table to map the raw input values from the analog to digital converter on the AI-10 device to temperature output values.

   To configure the translation table, right-click the AI-1 Temperature Sensor shape and select `Configure`. From the AI-1 Temperature Sensor plug-in dialog, select the `Analog Input` tab, and set **Translation Enabled** as shown in the following dialog. The device Offset displays *degrees F* if you are measuring in Fahrenheit or *degrees C* if you are measuring in Celsius. Celsius or Fahrenheit is determined by the Regional

Settings selected for Windows. In Device Offset, enter 32 for Fahrenheit and 0 for Celsius.



Click the Translation tab and enter the values into the translation table as shown in the dialog below (these are Fahrenheit values; Celsius values are shown below).



The raw measured data representing the resistance of the thermistor is translated into the output values representing temperatures. The temperature values are sent to the analog output network variable. The translation table provides a means for mapping the thermistor's set of input values into a different set of temperature output values via pairs of input/output values. The Analog Input software automatically linearly interpolates to determine translation values that lie between defined input/output pairs. Fahrenheit values are shown above; the values for Celsius are shown below:

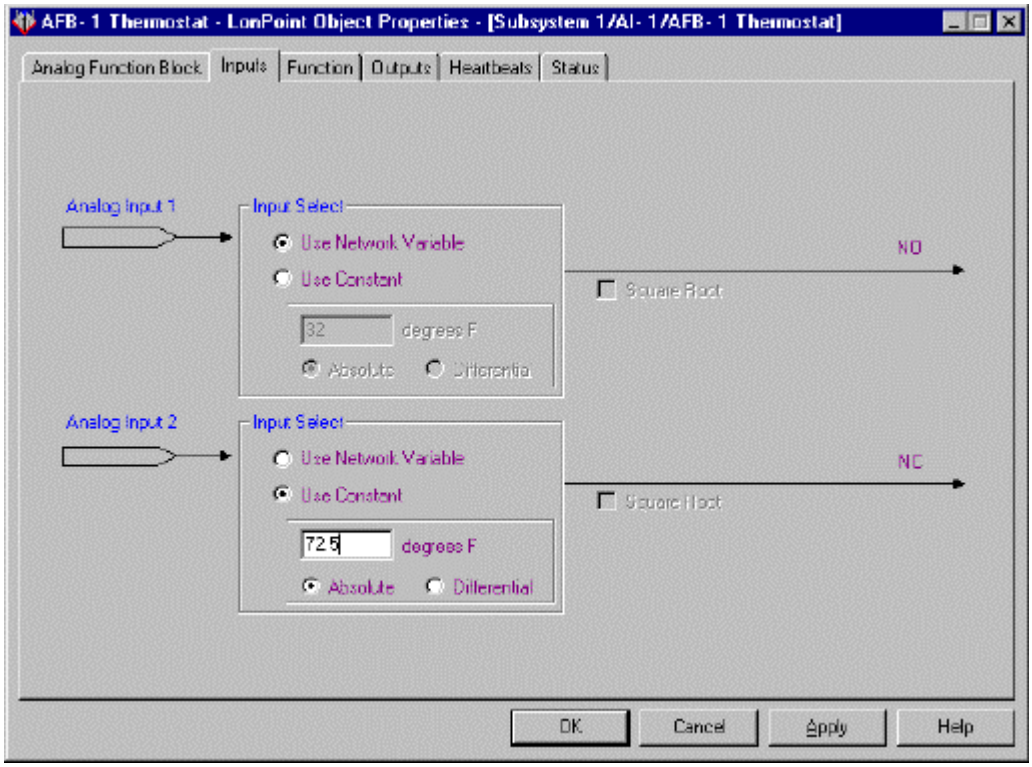
Measured Value	Output Value	Measured Value	Output Value
0	0	0	30
3000	7.5	0	30
7000	15	0	30
25000	22.5	0	30
50000	30	0	30
0	30	0	30
0	30	0	30
0	30	0	30
0	30	0	30
0	30	0	30

If you do not have a thermister, you can send a value onto the network by setting the override option and value. To set the override option and value, click the Output Parameters tab and enter the value that you wish to send in **Override Value**. Click the Status tab and select **Override On**.

When finished, click **Apply** and minimize the plug-in window.

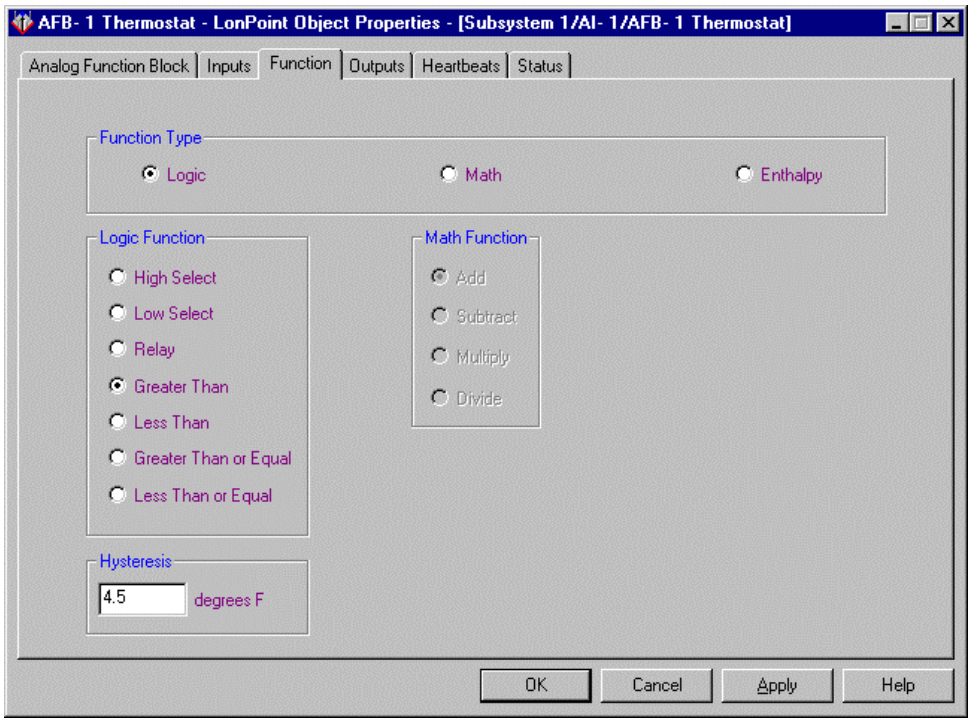
6. **Configure the Analog Functional Block**. The analog functional block representing the thermostat provides a means to define the hysteresis and setpoint that the temperature must reach before an action is taken. In this quick-start exercise, the action is turning on or shutting off the fan.

   To configure the analog functional block, right-click the AFB-1 Thermostat functional block and then click **Configure** on the shortcut menu. The AFB-1 Thermostat LonPoint Object Properties dialog appears.



Click the `Inputs` tab and select the Analog Input 2, **Input Select**, **Use Constants** checkbox as shown in the following dialog. Enter `72.5` (the setpoint) in **Degrees F** (or 22.5 **Degrees C**).

Click the Function tab (shown in the following figure).



For the Logic Function, select **Greater Than** as shown in the above dialog. For **Hysteresis**, enter 4.5 in degrees F (or 2.5 degrees C).

The Digital Output network variable will be set to On if the value from Operand 1 (temperature) is greater than the value from Operand 2 (setpoint). Otherwise, an Off value will be sent. Changes to the output value are affected by the Hysteresis value. The Hysteresis value determines how great a difference, as a floating point number, must exist between the analog values for the Greater Than logic function to change the digital output. In this example, if the temperature increases 2.5° above 22.5° C, the fan turns on. Conversely, if the temperature falls 2.5° under 22.5° C, the fan shuts off.

Click **Apply** and minimize the dialog.

7. **Verify Operation**. If you have physical LonPoint devices, you can verify network operation by monitoring the network variables. You can do this by double-clicking each Connector shape to enable monitoring of the network variables. Raise or lower the temperature to view a temperature change. As the temperature rises, the fan (represented by a LED on the DO-10 device) should illuminate. As the room cools down, the fan (LED) should turn off.

   The LonMaker tool includes the LonMaker Browser, a plug-in that allows you to view and modify network variables and configuration properties on one or more functional blocks or on all functional blocks and variables on a device. To start the LonMaker Browser, select one or more functional blocks, right-click one of them, and then click **Browse** on the shortcut menu. The Browser window appears and displays all the configuration properties and network variables in the selected functional block or blocks. For more information about the Browser, see *Using the LonMaker Browser* in Chapter 10, *Monitoring and Controlling Devices*.

Setting Up a Network Interface

If you plan on attaching to a network, you must define and configure your network interface before starting the LonMaker tool. If you are using an LNS network interface such as the i.LON 10, i.LON 100, PCC-10, PCLTA-10, PCLTA-20, PCNSI, SLTA-10, or PL-SLTA, install the

network interface hardware and configure the network driver as described in the documentation for the network interface. This documentation is available in an Echelon i.LON 10, Echelon i.LON 100, or Echelon Drivers program folder on you Windows Start menu (point to Programs, then select the appropriate Echelon folder).

Caution *For optimum performance when attached to LONWORKS networks, you should typically use an LNS Fast Network Interface (also known as a VNI), if a fast option is available for your network interface (a fast option is not available for RNIs such as the i.LON 10 or i.LON 100 Internet Servers, or for the SLTA-10 and PL-SLTA serial interfaces). An exception to this is if you are using a slow channel such as a PL-20 power line channel. In that case, a fast network interface is more likely to saturate the channel and a legacy interface may therefore be preferred. The drivers included with LonMaker 3 and later for Echelon's PCC-10, PCLTA-10, and PCLTA-20 cards all include upgraded firmware for an LNS Fast Network Interface as the default setting. THESE UPGRADED DRIVERS MAY NOT BE LOADED BY DEFAULT. In addition, the driver for these cards does not initialize until you open the control panel application for the driver. To select the LNS Fast Network Interface and initialize the driver, follow these steps:*

---

1. Open the Windows **Start** menu, point to **Settings**, then choose **Control Panel**.
2. Open the LONWORKS Plug 'n Play control panel application.
3. Under NI Application, select the application name with "VNI" in the name.
4. Click OK to close the control panel application.

If you are using an i.LON 1000 Internet Server, follow these steps to set-up your LonWorks/IP interface and create your LonWorks/IP channel

1. Ensure that all of your LONWORKS/IP devices, which may include the LNS Server computer, one or more LonMaker computers, and one or more *i*.LON servers, all have static IP addresses. A static IP address is an address that is not dynamically assigned by a DHCP server. If you need clarification on your IP addresses, see you information systems representative. They can assign you the required static IP addresses for your LONWORKS/IP devices.
2. Create a LONWORKS/IP interface on each computer that is to be connected to the LONWORKS/IP channel. This may include the LNS Server computer and one or more LonMaker computers. To create a LONWORKS/IP interface, follow these steps on each of the computers:
   a. Open the Windows Start menu, point to **Settings**, then choose **Control Panel**. The Windows Control Panel opens.
   b. Double-click the LonWorks/IP Channels control panel application in the Windows control panel.
   c. Click **Add**. The Add an IP Device dialog opens.
   d. Enter a unique name for this LONWORKS/IP interface and verify that the displayed IP address is correct.
   e. Click **OK**. The Add an IP Device dialog closes.
   f. Click **OK**. The LonWorks/IP Channels control panel application closes.

   See the LonWorks/IP Channels control panel application help file for more information.
3. Define the LONWORKS/IP channel and devices in the *i*.LON Configuration Server. To do this, follow these steps:

a. Open the Windows **Start** menu, point to **Programs**, then point to **Echelon *i*.LON**, and then choose **i.LON Configuration Server**.

b. Open the **Channel** menu and select **New Channel**. Enter a name for the new LONWORKS/IP channel.

c. Right-click the channel you just created and then click **New Device** on the shortcut menu. Enter a name for your computer on the LONWORKS/IP channel.

d. Right-click the new device and then click **Device Properties** on the shortcut menu. Enter the IP address for the device.

e. Repeat steps c and d for each computer and i.LON 1000 server on the LONWORKS/IP channel.

The devices on the LONWORKS/IP channel will not be fully commissioned on the LONWORKS/IP channel until you run LNS applications such as the LNS Server or LonMaker tool on each of the computers. For more information, see the *i.LON Configuration Server Help* file or the *i.LON Configuration Server User's Guide*.

Creating and Using a LonMaker Network Design

A LonMaker network design consists of a LonMaker drawing and an LNS network database. The LonMaker tool provides several methods to create a LonMaker network design. Your selection of a LonMaker network design creation method depends on your current physical network. Consider the following possibilities:

- The network is not operational at this time. You need to create a new network design as described in the *Create a New LonMaker Network Design* section.
- The network is operational. In this case, you have three choices:
    - If the network was created with an LNS tool, but not the LonMaker tool, you can automatically create a drawing based on the LNS database for the network.
    - If the network was created with a non-LNS tool or was self-installed, you can use the LonMaker recovery process to automatically create a drawing and LNS database.
    - If you would like to start over, you can create a new LonMaker network design.
    - If you already have a LonMaker network design for he network, you can open it.
    - If you have a LonMaker backup file, you can restore the LonMaker network design.

This section shows you how to:

- Create a new LonMaker network design
- Automatically create a drawing from an existing LNS database
- Automatically create a LonMaker network design, both a database and a drawing, from an existing physical network using the network recovery process
- Open an existing LonMaker network design
- Open a copy of an existing LonMaker network design

If you have an operational network, you will probably want to use the recovery method to create your LonMaker network design. The LonMaker tool can determine what devices are present without changing their application or network configuration properties. Although the recovery

process can save considerable time, there are limitations. See *Recovering a Network* in this chapter for more information.

If the database and drawing files were lost, you should always restore from a LonMaker backup file if available. Some information will be lost when recovering from a physical network. See *Restoring a LonMaker Network Design* for more information.

The following sections describe how to create, recover, open, and copy, a LonMaker network design.

Creating a LonMaker Network Design

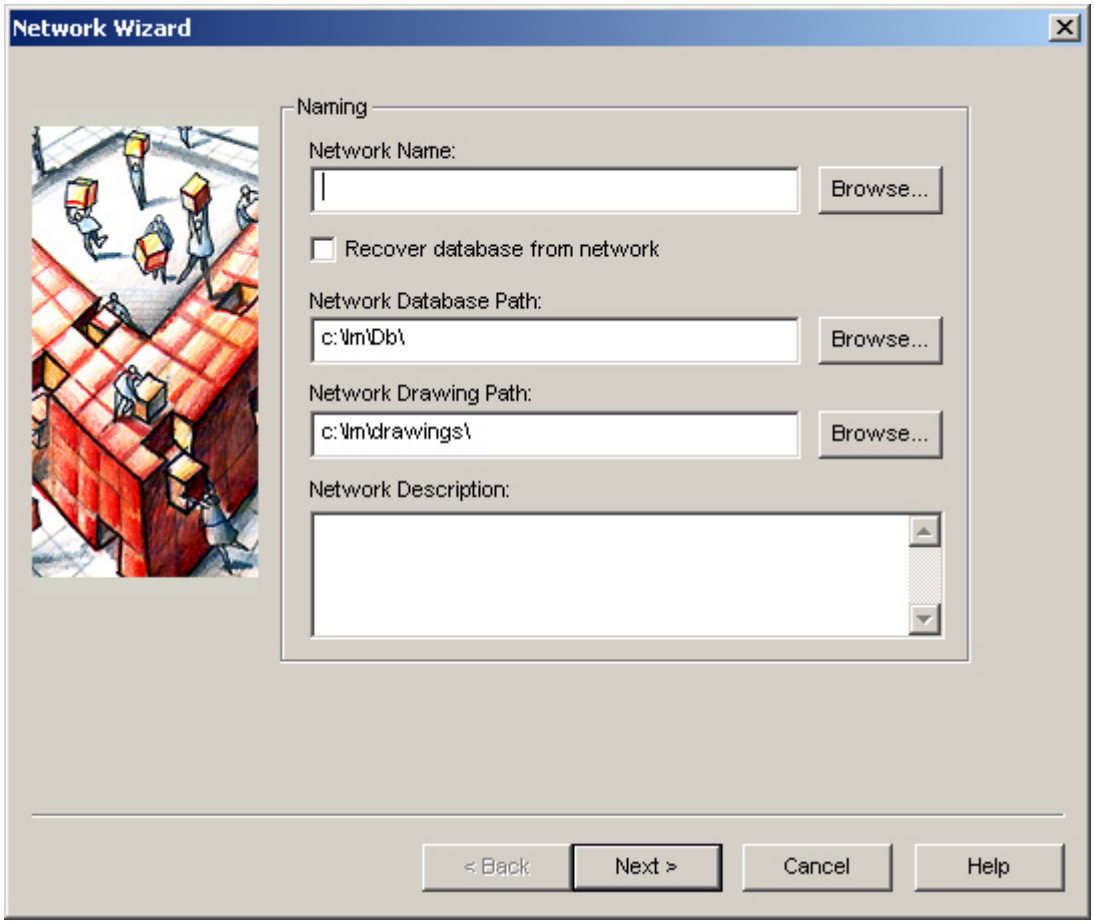
To create a new LonMaker network design, use the LonMaker tool locally (on the same computer as the LNS server). If you are using the LonMaker tool on a *remote full client* or a *remote lightweight client*, you can open an existing network design, but you cannot create or copy a LonMaker network design.

Note: Creating a new network design may take some time since the LonMaker tool may register the plug-ins available on the host computer. If you will be creating multiple LonMaker network designs, you can save start-up time by using the following procedure to create a LonMaker drawing called `Blank`. After the last step of the following procedure, exit the LonMaker tool. Once you have created the `Blank` LonMaker network, you can create a new network design by opening a copy of `Blank` as described under *Opening a Copy of an Existing LonMaker Network Design*.

If you plan on attaching to a network, you must define and configure your network interface before starting the LonMaker tool as described in *Setting up a LonWorks or LonWorks/IP Network Interface*. To communicate on a LonWorks/IP channel, the PC must be configured as an IP device on the target channel using the *i*.LON Configuration Server. If an IP interface name has not been defined, create one using the LonWorks/IP Channels control panel application found in the Windows Control Panel. You need an IP address and it must be a static IP address on your PC (not an IP address that was automatically found by a DHCP server, for example). For more information on static addresses, contact your information services representative. For more information on using the LonWorks/IP Channels control panel application, see the *i.LON 1000 Internet Server User's Guide*.

To create a new LonMaker network design, follow these steps:

1. If this is the first time you are running the LonMaker tool, shut down any virus detection software before starting. Once you have opened LonMaker for the first time, you can run virus protection software without any problems.
2. Open the Windows **Start** menu, point to **Programs**, then point to **LonMaker for Windows**. The LonMaker Design Manager appears.
3. Click **New Network** to open a new network design. A warning may appear asking you if you want to enable macros. You must enable macros to use the LonMaker tool. See *Working with Digital Signatures*, later in this chapter, for more information.
4. Visio starts and the Naming window appears.

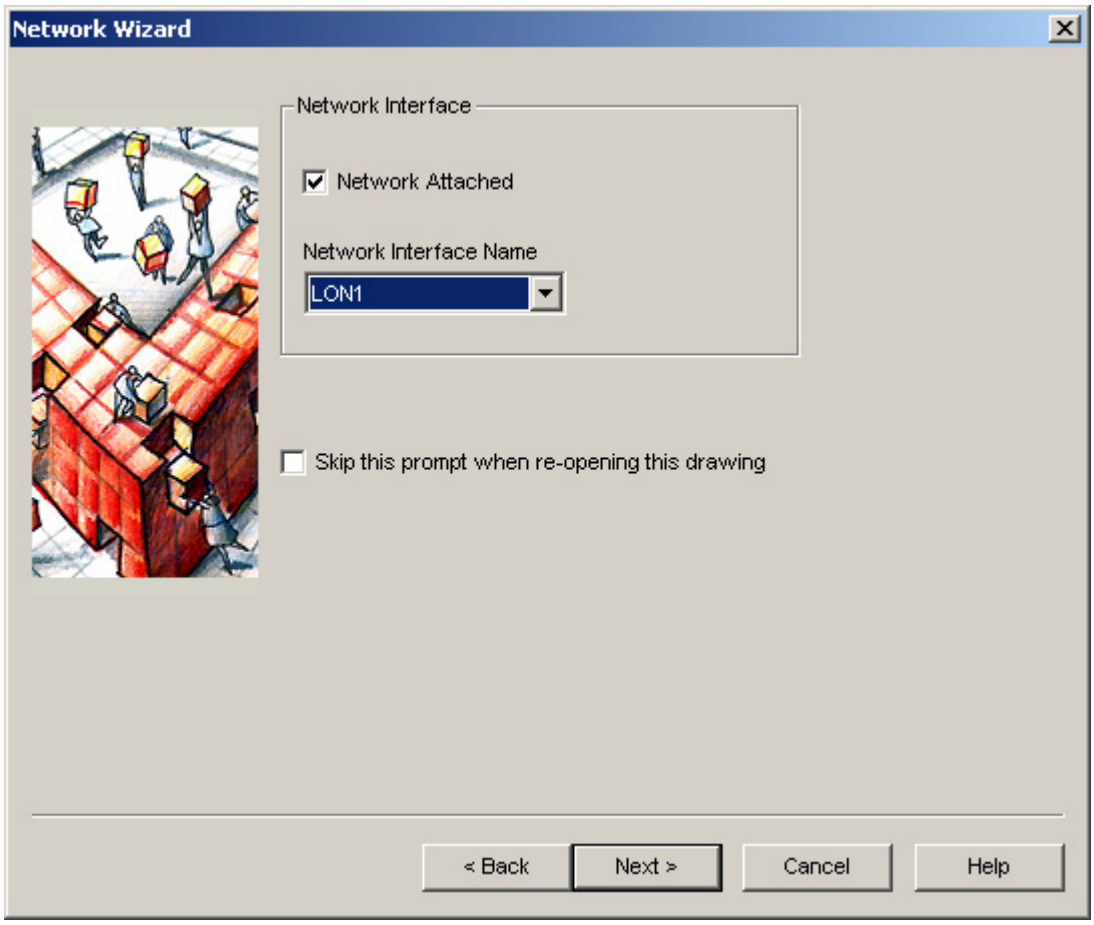


5. Edit the following fields as required:

Network Name	Specifies the name of the LonMaker network design to be created. It must be unique to all the LNS networks on this computer. The network design name can be up to 17 characters (and may include embedded spaces). The network name is not case sensitive (i.e. you must not create two networks with names that differ only in capitalization).
Recover Database From Network	Set this checkbox and enter a unique network design name to *recover a database* from the network.
Network Database Path	Specifies the directory containing the LNS network database. The LonMaker tool automatically updates this field. You can modify this field to place the LonMaker network database in another directory; however, the directory name must match the network name. The network database path can be up to 23 characters.
Network Drawing Path	Specifies the directory containing the LonMaker drawing and the filename of the top-level drawing file. The LonMaker tool automatically updates this field. You can modify this field to change the drawing path; however, the final subdirectory of this directory and the file name must match the network name.
Network Description	Contains a description of the network design being created. This

field is optional and has no effect on network operation. It provides additional documentation for as-built reports.

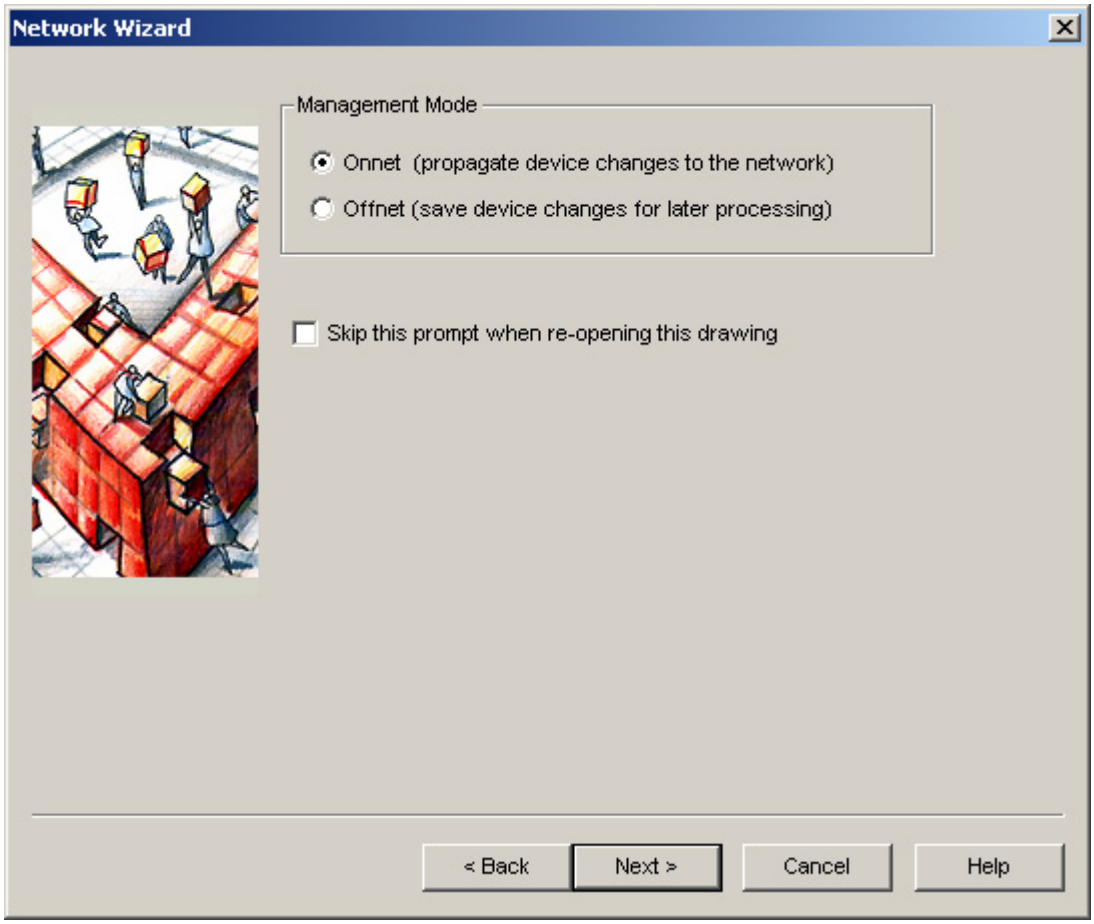
6. Click `Next`. The Network Wizard opens the Network Interface window:



7. Set **Network Attached** if the LonMaker computer is attached to the physical network and you wish to communicate with the physical devices. If this option is selected and you have more than one network interface in your computer, select the name of the LNS or LONWORKS/IP network interface under **Network Interface Name**.

   This window appears every time the network database opens using the LonMaker tool unless **Skip This Prompt** is set and **Show All Network Options Screens** is cleared on the LonMaker Design Manager window. Select **Network Properties** from the **LonMaker** menu once the file is open to change this property.

8. Click **Next**. The following window opens if the network is attached. If the network is not attached, skip to step 9.



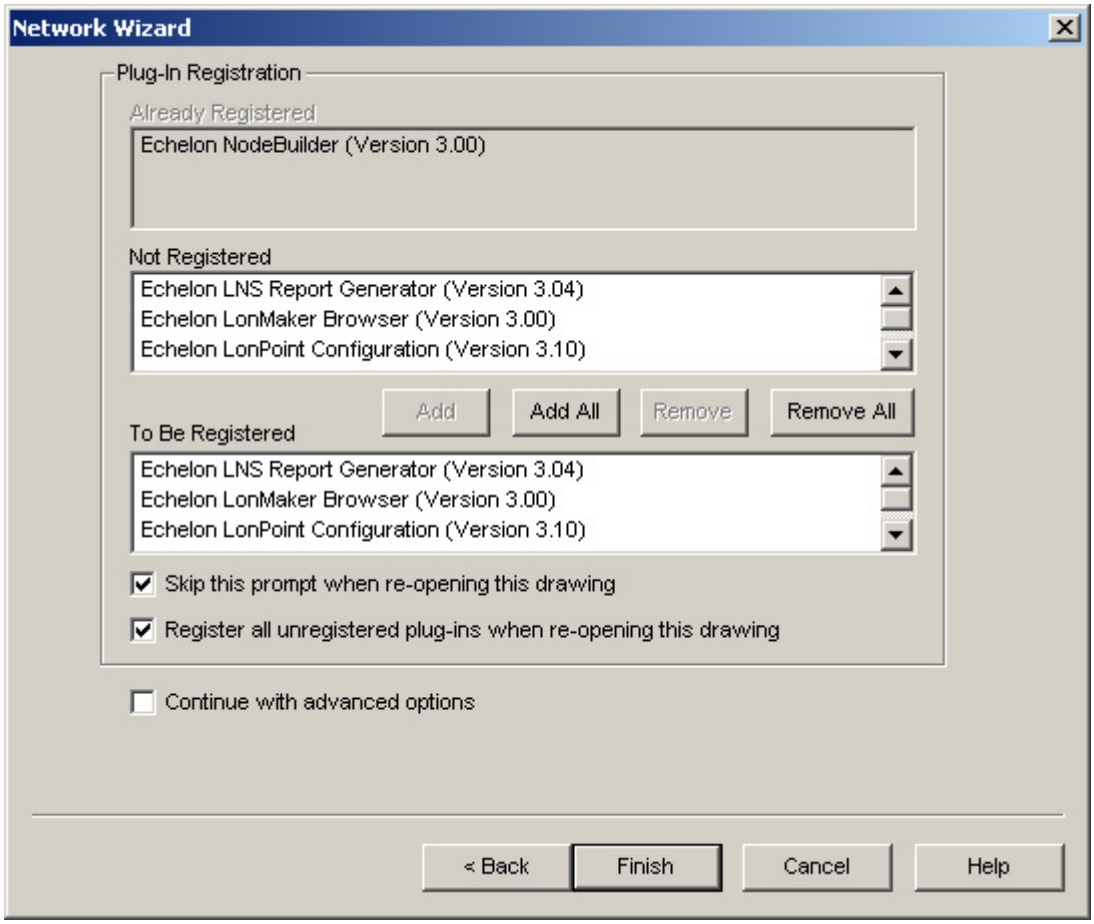
9. This window allows you to select one of the two following management modes:

- `OnNet` — All changes to the LonMaker drawing will immediately be sent to the physical devices on the network; you can see the effect of every change made to the physical devices as they are made. Select OnNet if you are commissioning an engineered system, or if you are in any phase of an ad-hoc system.

- `OffNet` — Changes to the LonMaker drawing are not sent to the physical devices until the LonMaker tool is placed OnNet, at which point all changes made while OffNet will be implemented. After you have commissioned devices while OnNet, you can work OffNet and still make real-time changes to network variables on an attached network. Changes made to configuration properties, which happen less often, can be made OffNet and are stored in the database until you select OnNet, You can, however, read configuration properties while you are working OffNet. This capability allows you to make many changes rapidly without having to wait for every change to modify the physical devices. You can change the OnNet/OffNet status while the drawing is open. From the LonMaker menu, select Network Properties and the OnNet/OffNet tab. Select the desired setting.

  This window appears every time the network database is opened using the LonMaker tool unless **Skip This Prompt** is set and **Show All Network Screens** is cleared in the LonMaker Design Manager. Select **Network Properties** from the **LonMaker** menu once the network is open to change this property.

10. Click **Next**. The Plug-In Registration window appears.



11. This window allows you to choose which plug-ins to register for this network. Plug-ins are LNS applications that can be started from within the LonMaker tool to perform a specialized task, often relating to a specific type of physical device or functional block. For example, the LonPoint plug-in provides specific user interfaces for reading and setting the configuration properties on LonPoint functional blocks. Other device manufacturers may provide plug-ins you can use to configure their devices. See Chapter 9, *LNS Plug-Ins* for more information.

    Some plug-ins, such as the LonMaker Browser, can be registered at the LNS Server level and, if registered at this level, will appear in the **Already Registered** list when you create a new network. If no plug-in applications have been registered at the LNS Server level, the **Already Registered** list in the window above appears empty. The **Not Registered** list contains all available plug-ins. The **To Be Registered** list contains the plug-ins that will be registered for use with this network. You may add or remove plug-ins from the **To Be Registered** list using the **Add**, **Remove**, **Add All**, and **Remove All** buttons or by double-clicking the plug-in to be added or removed.

    This window appears every time the network database is opened using the LonMaker tool unless **Skip this Prompt** is set and **Show All Network Screens** is cleared in the LonMaker Design Manager. If **Skip this Prompt** is set and the **Register all Unregistered** checkbox is set, new plug-ins will be registered automatically when the network is opened.

12. Click **Finish** to open a LonMaker drawing containing a LNS Network Interface on Channel 1.

13. If you created this network attached to a LONWORKS/IP channel on a WAN or the Internet, change the channel's transceiver type in channel properties. Right-click the channel and then click **Properties** on the shortcut menu. Set **Transceiver Type** to **IP 10-W**. Click **OK**.

The IP interface defaults to use the IP-10L transceiver type, which is correct if you are using IP across a LAN. If you are using IP across a WAN or the Internet, use the IP-10W type instead. The IP-10L transceiver has a channel delay of 50ms and the IP-10W has a channel delay of 500ms.

Working with Digital Signatures

Visio drawings can have VBA code associated with them through the use of macros and ActiveX objects. Visio drawings that use this capability use Microsoft VBA signatures to provide security from VBA viruses. Each time you create a LonMaker network design, the template that you selected in the LonMaker Design Manager (LonWorks.vst by default) is used to create the network drawing. This template uses VBA macros to implement the network drawing's LONWORKS functionality. This template, and all Visio drawings created from it, are signed by the Echelon Corporation.

When creating or opening a LonMaker 3.1 network for the first time, a dialog pops up informing you that the drawing being opened contains macros from the Echelon Corporation, and asking you if you would like to enable macros for this drawing. You **must** enable macros in order to use the LonMaker tool. If you set **Always Trust Macros from this Source** you will automatically enable macros for all LonMaker drawings that are signed by Echelon.

LonMaker network drawings created with LonMaker versions before 3.1 will not have a digital signature. LonMaker drawings created with LonMaker 3.1 or later may have expired digital signatures. In addition, you can cause a LonMaker drawing to lose its Echelon signature by adding VBA code to it. This can happen if you add an ActiveX object, such as the LNS Text Box control, to the drawing, or if you add VBA code to the network drawing. Once a network drawing has lost its signature, it cannot get it back automatically. If you have lost Echelon's signature on a network drawing, you have the following three options: 1) ignore the macro warnings as described in the next paragraph; 2) disable macro warnings as described in the next paragraph; or 3) sign the drawing with your company's digital signature as described at *msdn.microsoft.com/library/default.asp?url=/library/en-us/odeopg/html/deovrusingdigitalcertificatestoproducetrustedsolutions.asp* .

If a LonMaker drawing does not have a digital signature, you will see the macro warning dialog and will have to enable macros every time the network drawing is opened, provided Visio's macro security is set to medium (the default). In order to change Visio's macro security, open the **Tools** menu, point to **Macro** and then select **Security**. A dialog opens allowing you to select **Low**, **Medium**, or **High** security. If you select **Low** security, you will never see the macro warning (this option is equivalent to the setting in LonMaker 3.0 (Visio 2000)). If you select **Medium** security, you will be prompted to enable macros for unsigned network drawings or network drawings signed by companies that have not been added to the trusted signatures list. If you select **High** security, macros will automatically be disabled (and the LonMaker tool will not function) for unsigned network drawings, and you will be prompted to enable macros for network drawings signed by companies that have not been added to the trusted signatures list. Visio's security level is persistent. When you change Visio's security level, it will be the security level for Visio every time it is started until you change it again.

Creating a Drawing for an Existing LNS Database

You can create a new LonMaker drawing by opening an LNS database that does not already have a LonMaker drawing. The LonMaker tool will then create a drawing for the database.

This procedure is useful in a variety of situations. For example, it can be used to import an existing network into the LonMaker tool when that network was installed with another LNS installation tool.

To create a LonMaker network drawing from an LNS network, you must be running the LonMaker tool on the computer containing the LNS database. The LonMaker tool will not create shapes for devices attached to the network but not commissioned by LNS.

To open the LNS network, follow these steps:

1. Open the Windows **Start** menu, point to **Programs**, then point to **LonMaker for Windows**. The LonMaker Design Manager appears.
2. Select the name of the database to be opened in **Database Name**. If the database has no associated drawing, the text **<none>** will appear in **Drawing Directory** and the **Open Network** button will be replaced with a **Create Drawing** button. Click **Create Drawing**. The Design Manager launches Visio and initializes LNS. Upon completion, the Naming window appears.
3. Specify the directory path where the network drawing will be created. The Drawing Directory name must be the same as the network name. Change the **Network Drawing Path** value, as desired. The network name and network database paths are determined by the LNS network database and may not be modified. Click **Next**. The Network Interface window appears.
4. Select whether the network is attached, and specify the `OnNet` or `OffNet` mode as in steps 5 through 7 of *Creating a LonMaker Network*. When complete, click **Finish**. The Synchronization Options window appears.
5. Select the desired synchronization options, subsystem assignment, and stencils to be scanned using the resynchronization wizard. See *Resynchronizing the Drawing, Database, and Network* (steps 7-12) for more information. In the final wizard window, click **Finish**. A new LonMaker drawing is created, and the synchronization process begins.

Recovering a Network

You can create a new LonMaker drawing and LNS database for an existing operational network. This is useful for networks that were installed with legacy tools that were not based on LNS, for recovering self-installed networks, or for networks installed by an LNS tool but where the LNS database has been lost.

The recovery process uses the Database Recovery Wizard to create a LonMaker network design. The wizard retrieves as much information as possible from the network devices, given a network domain ID and optionally a database description file, and builds a complete LNS database and LonMaker drawing.

Even though it can rebuild the entire network database, database recovery is **not** a replacement for backing up a LonMaker network database. Database backup has these advantages:

- **Faster.** Copying a database directory to make a backup is much faster than database recovery. To recover the database, the LNS Server must scan the network to discover all the devices, upload the small slice of the overall network configuration that it stored in each device, and then deduce from these small slices what the network database should be. This data collection and reconstruction process grows roughly linearly with the complexity of the network where complexity is a function of the number of devices, network variables, channels, and connections.
- **More complete.** Database recovery only recovers attributes and properties stored in the devices themselves; host-based information, such as subsystems and device names, may not be recovered. In addition, the recovery process might fail to create an exact duplicate of the original database. That is, if you compare a recovered database to the original database, there will be differences, because there are many objects, properties and attributes that cannot be identified uniquely and unambiguously. For example, the handles assigned to devices, routers, and so on will probably differ, and connection hubs and targets may change. Database recovery may also be incomplete if the network itself is inconsistent. A network could become inconsistent if, for example, the network tool failed while in the process of updating the configuration of a series of devices. In such a case, some devices would contain new information while other devices contain old information. When recovering this network,

there is no way for the Recovery Wizard to determine which information is old and which is new. See below for more details.

- **More reliable**. Although the recovery process is designed to be as reliable as possible, successful recovery of a database from a given network relies on that network being well behaved, properly configured, and not saturated by regular network traffic. Additionally, authentication can prevent parts of a network from being recovered.

For all of these reasons, you should use database backup as the primary means of protecting against database loss. If your application warrants greater protection, you may want to use a redundant array of independent disks (RAID) for the LNS Server. For maximum performance and reliability, you can use a RAID 5 disk array.

If a backup file is not available, the recovery process is an option. Before beginning, consider the following inconsistencies that will result in changes to network variable and address table entry configuration:

- If a bound source network variable has no associated source or target, it is marked as unbound. No address is associated with this network variable.
- If a bound dedicated message tag has no targets, its address table entry is marked as empty.
- Any address table entries that are not associated with a network variable or message tag (source or target) are marked as empty. A lost source or a lost target may create this situation. Group use counts are updated as necessary, and group IDs are freed as necessary.
- The recovery process has no way of determining what network variables are hubs and what network variables are targets. These relationships are arbitrarily assigned.
- Because the hub/target relationships may change, the recovery may not faithfully restore all connection descriptions. If the recovery is unable to determine the correct connection description for a connection, it uses the default connection description.

The Recovery wizard requires you to input very specific, accurate information as it walks through the database recovery process. As a result, for an optimal recovery you must be very familiar with the network configuration from which the wizard will create the database (such as subsystem, channel, device, and connection configuration details—for example, whether default values are used and, if used, the specific default values). For best results you should have detailed, expected results prior to using database recovery. In addition, ensure that all components of the network are present and functioning properly before the recovery process starts as the wizard cannot, for example, recover a router or device that is not present. If a router is not recovered, all devices on the router's far side will not be included in the database when you commission the network following the recovery process.

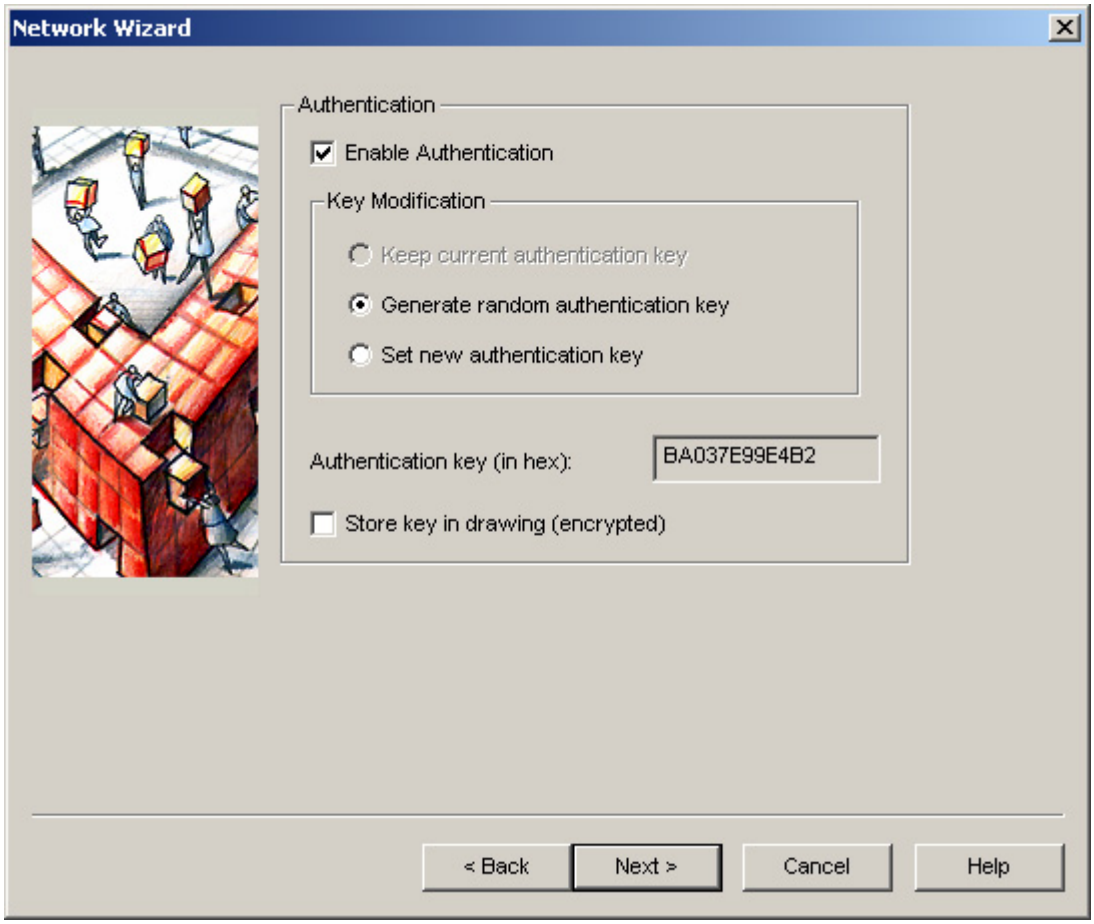
If you have a LonManager database for which you wish to create an LNS database, you can use the LonManager CSV utility (for either DOS or Windows) to create a comma-separated value (CSV) file from the LonManager database as input to the wizard. The CSV file is a dump of the LonManager database and contains information such as device names that the wizard uses to create a more complete LNS database.

The recovery wizard logs the recovery tasks, as well as any errors that occurred in the detailed recovery log. A trace log lists the steps with time and date that the wizard went through to recover the database. You can view the logs in a wizard dialog after the database has been reformatted. These logs are useful for tracking any errors that the recovery process encounters, such as connection errors or lost data.

To recover a network, follow these steps:

1. From the LonMaker Design Manager, click **New Network**. The Network Wizard appears.
2. Enter a unique network name, and set **Recover Database From Network**. The Network Interface dialog appears.

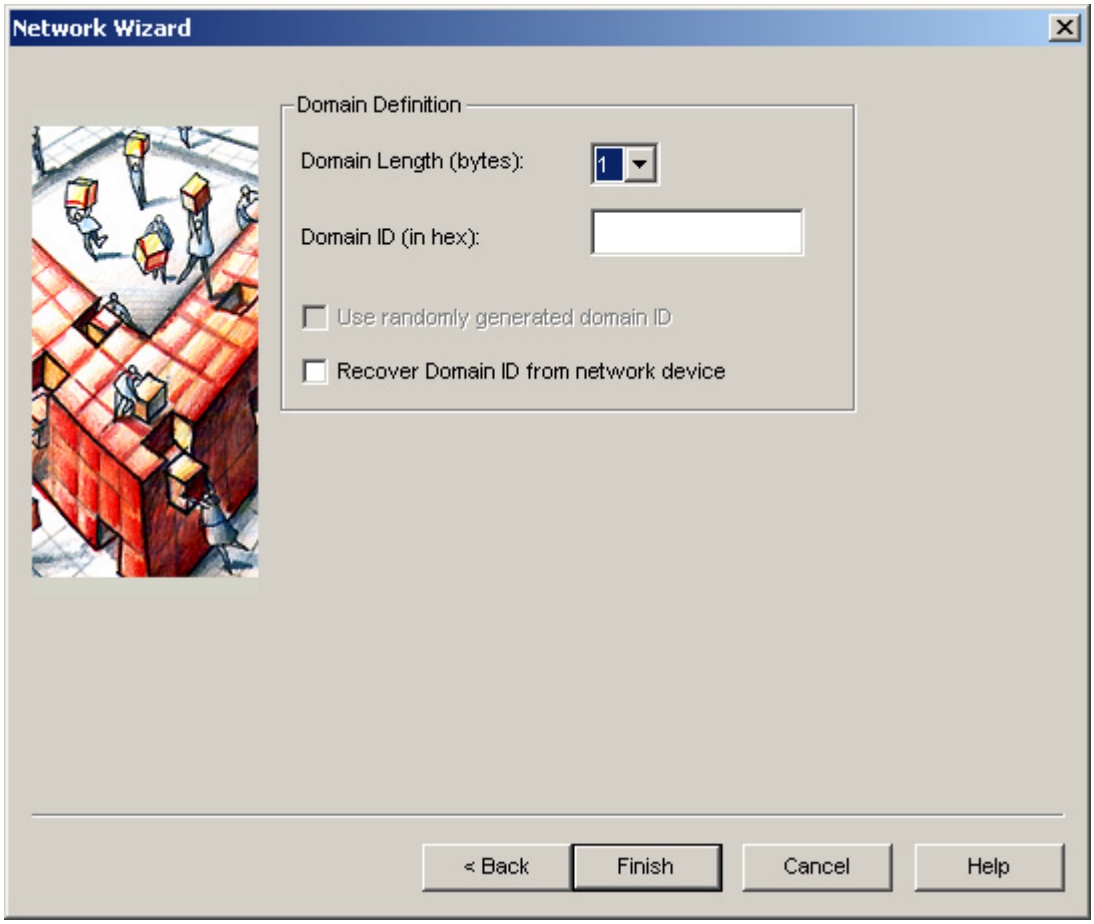
3. Select the **Network Interface** and click **Next**. The Plug-In Registration dialog appears.
4. Select any Plug-Ins you wish to register or remove and click **Next**. The Authentication dialog appears.



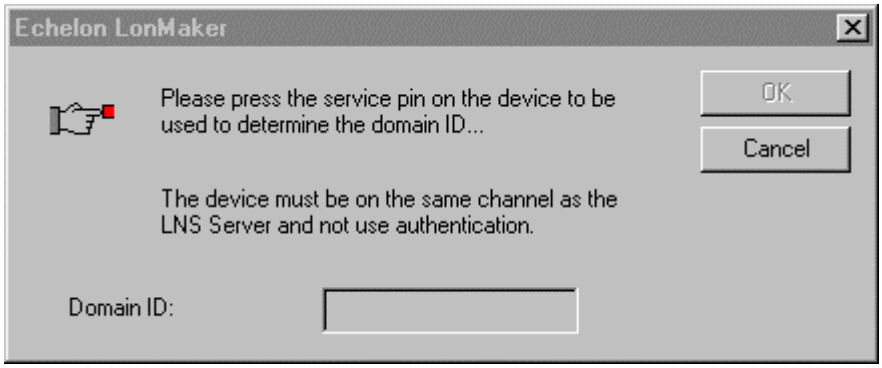
5. If you use authentication on your network, set **Enable Authentication** and **Set New Authentication Key** under **Key Modification**. You must enter the correct authentication key for your network.

Caution	*If you do not enter the correct authentication key, the LonMaker tool cannot recover your database!*

Click **Next**. The Domain Definition dialog appears.

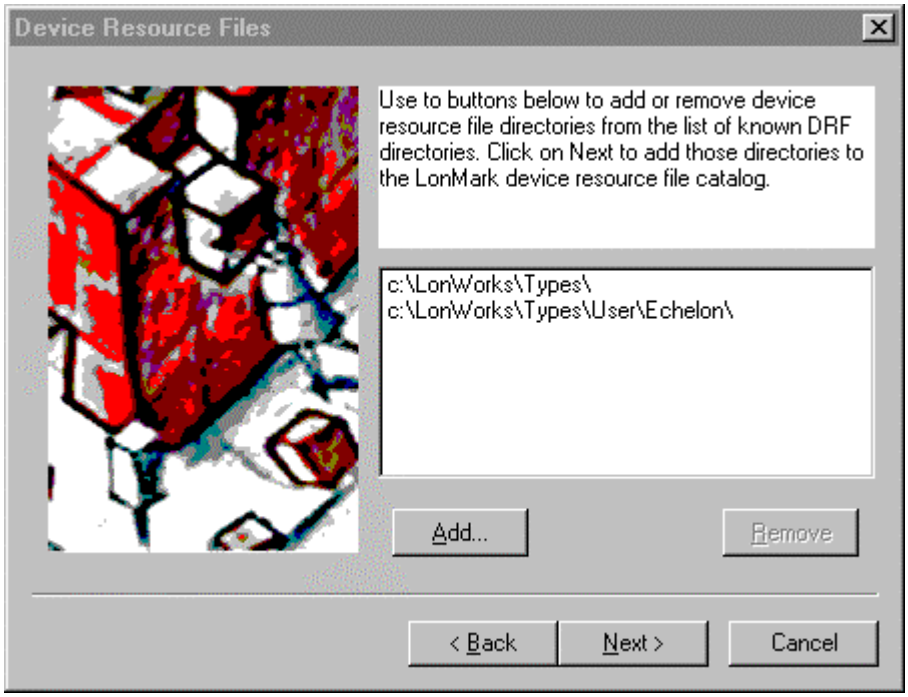


6. If you know the Domain ID of the network that you want to recover, enter it in hexadecimal format into **Domain ID**. If you do not know the Domain ID, set **Recover Domain ID from Network Device**. You must have access to the service pin on an unauthenticated device on the same channel as the network interface to use this feature. Click **Finish**.
7. If you selected the option to recover the domain ID from a network device, the following dialog appears. Press the service pin on one of the unauthenticated devices on the same channel as the network interface. Click **OK**.

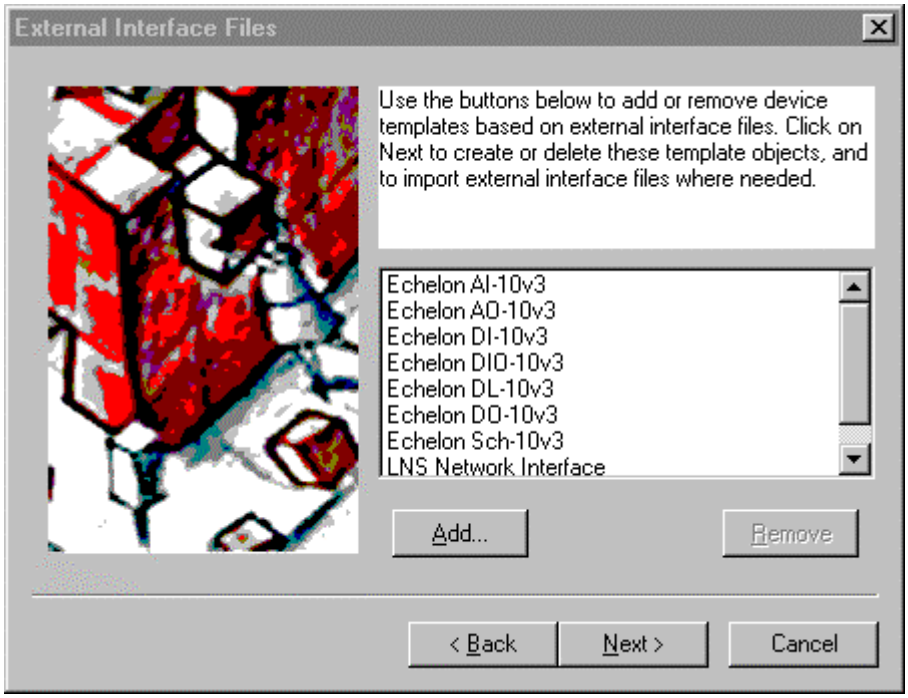

Echelon LonMaker
Please press the service pin on the device to be used to determine the domain ID...
OK
Cancel
The device must be on the same channel as the LNS Server and not use authentication.
Domain ID:

8. The Database Recovery Wizard Welcome window appears. Click **Next** to continue. The Device Credit Note window appears.

9. Set **Deduct LonMaker Credits**, if appropriate. Guidelines are provided. Click **Next** after you have made your selection. The What Would You Like To Do Now? window appears.
10. Set **Recover a Network** and click **Next**. The Wizard describes instances when the **Resume from Unfinished Recovery** selection would be appropriate. The Select LonManager Database window appears.
11. Unless you have a LonManager database, set **No Such Input Available** and click **Next**. The Wizard describes when the other options are appropriate. The Recovery Options window appears.
12. If you expect your network to have more than 200 devices, set **Large Network**. Otherwise, leave it clear. The Recovery Options window shows the Domain ID and Authentication Key. Click **Next** to continue. The Device Resource Files window appears.
13. Resource files define the components of the external interface for devices. There may be one or more sets of user resource files from one or more manufacturers. Each set of resource files may be kept in a separate directory. These directories are typically installed in the LONWORKS Types\User directory. If you have resource files whose directory is not shown, create a subdirectory under the LONWORKS Types\User directory and copy the files to it. Then, click **Add** on the Device Resource Files window. An Open window appears. Select the desired subdirectory or subdirectories. Click **Next** when the directories containing the desired Device Resource Files are shown. The External Interface Files window appears.

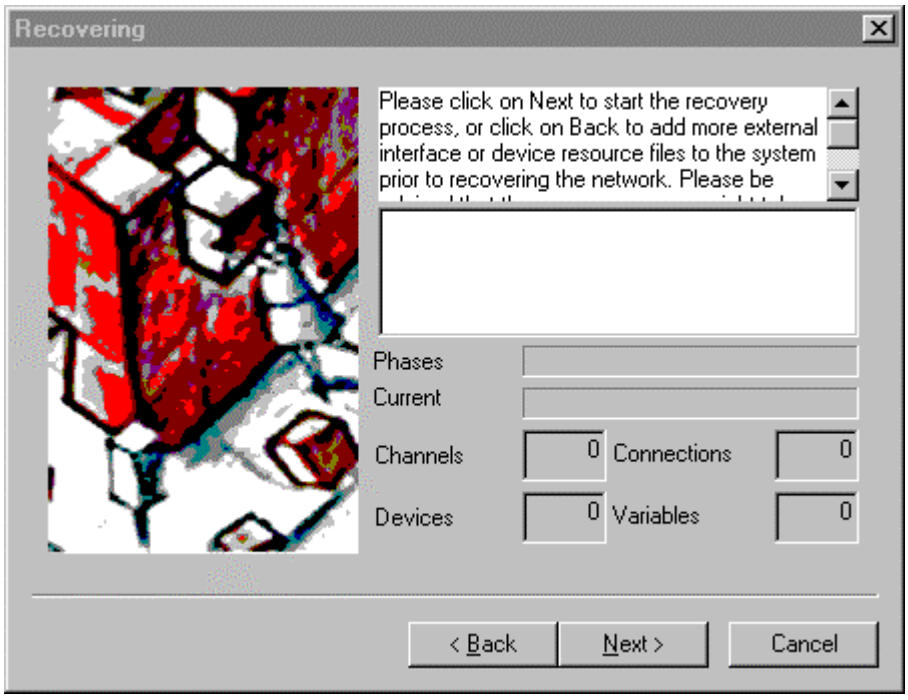

Device Resource Files
Use to buttons below to add or remove device resource file directories from the list of known DRF directories. Click on Next to add those directories to the LonMark device resource file catalog.
c:\LonWorks\Types\
c:\LonWorks\Types\User\Echelon\
Add...
Remove
< Back
Next >
Cancel

14. Add or remove device templates based on device interface (XIF) files. The graphic below displays the window with examples.


External Interface Files
Use the buttons below to add or remove device templates based on external interface files. Click on Next to create or delete these template objects, and to import external interface files where needed.
Echelon AI-10v3
Echelon AO-10v3
Echelon DI-10v3
Echelon DIO-10v3
Echelon DL-10v3
Echelon DO-10v3
Echelon Sch-10v3
LNS Network Interface
Add...
Remove
< Back
Next >
Cancel

When finished, click **Next**. The Recovering window appears.

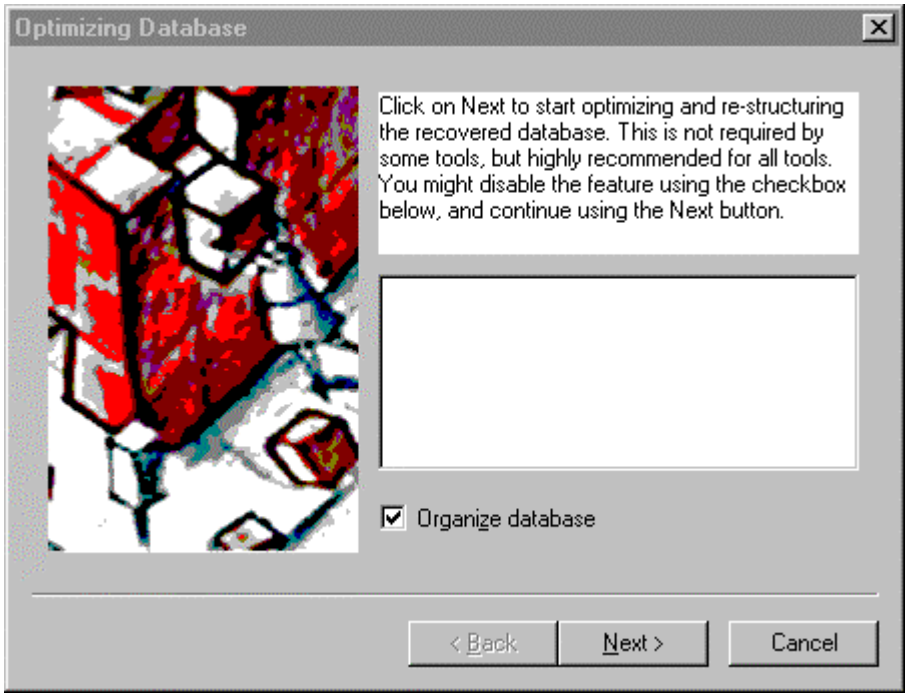
15. Click **Next** to begin the recovery process.



The Optimizing Database window appears when this stage of the recovery process is complete.

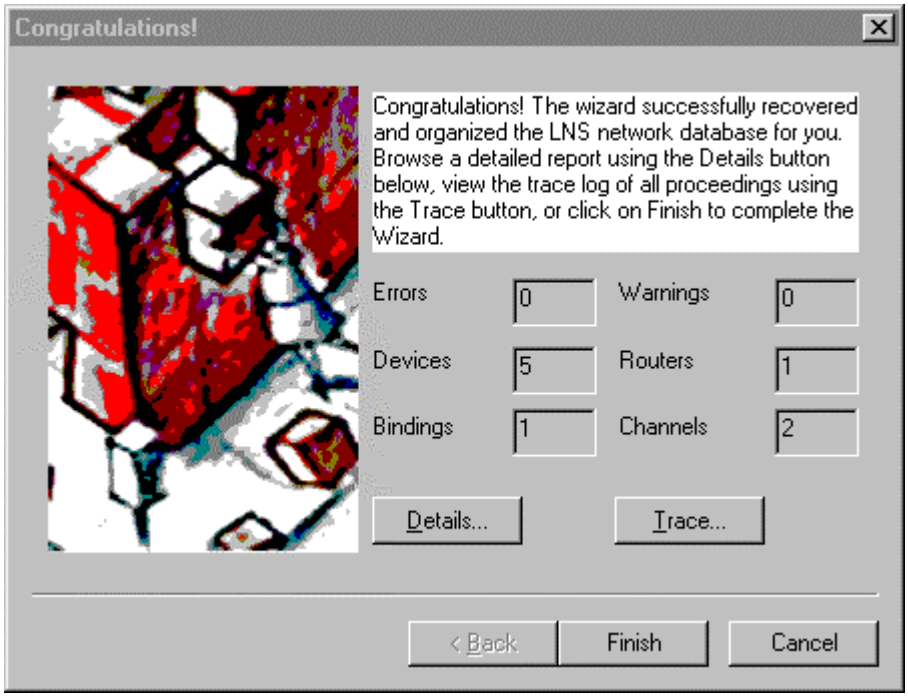
16. Set **Organize Database** and click **Next**.

Caution *Organizing the database is necessary to create the LonMaker drawing.*


Optimizing Database
Click on Next to start optimizing and re-structuring the recovered database. This is not required by some tools, but highly recommended for all tools. You might disable the feature using the checkbox below, and continue using the Next button.
Organize database
< Back
Next >
Cancel

During the recovery process, you will see numerous messages appear as the Database Recovery Wizard works. Duration of the recovery process depends on the size of the network. At the conclusion, a Congratulations window appears.

17. The Congratulations window (shown below) displays the number of errors, devices, bindings, warnings, routers, and channels found.



This window provides valuable information to help you validate your network design after the synchronization process that follows this window.

Verify that the number of devices, routers, bindings, and channels match your physical network.

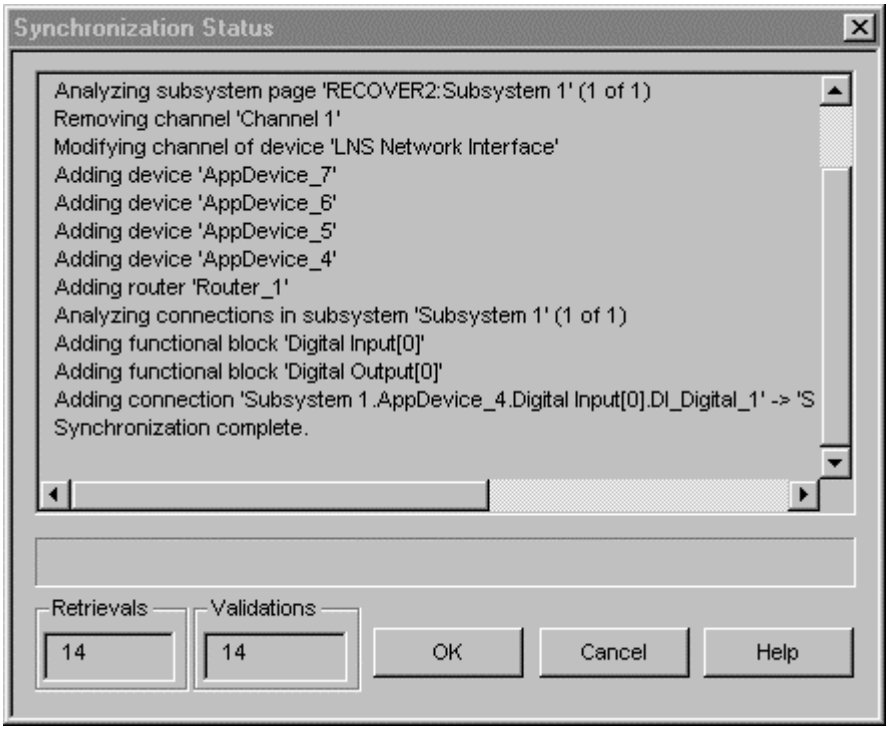
If there are any Errors or Warnings, click **Details**. The Details window provides a recovery log with the recovery steps and any problems encountered. Save this information to file or print it for future use. Errors should be investigated prior to setting the final network design into the OnNet management mode. Warnings should also be researched, but are not as serious as Errors. `Trace` displays the steps of the recovery process.

Click **Finish** to continue. The Synchronization Options dialog appears.

18. On the Synchronization dialog, you usually leave the defaults selected. Always set **Automatically Drop Device, FB, and Subsystem Shapes**. The LonMaker tool automatically adds shapes from the stencils to the drawing. Clear **Create Shapes for all Connected NVs/MTs** only to simplify the drawing. The **Use Reference Shapes for all Connections** option is frequently not selected, because the drawing may become too complex. If you need help, refer to step 7 in *Resynchronizing the Drawing, Database and Network* in the Maintaining Networks chapter. Click **Next**. The Select Stencils dialog appears.
19. During the synchronization process, LonMaker searches, in order, all the listed stencils in this dialog for master shapes based on type. Add, remove, and order stencils as described below. Click **Finish**.

Add Stencil	Adds a stencil file to the bottom of the search list.
Remove	Deletes the selected stencil file from the search list.
Move Up	Promotes the selected stencil file one position.
Move Down	Demotes the selected stencil file one position.

The synchronization process starts and status is displayed in the status dialog. An example with a very small network is shown below.



20. Click **OK** when synchronization completes to return to the recovered network drawing in the LonMaker tool.

21. Verify that the LonMaker drawing accurately represents the network. Most important—ensure that all devices on the physical network appear on the drawing and that all connections between the devices appear on the drawing. If appropriate, refer to the recovery log you saved or printed at the conclusion of the recovery process. If you did not save or print this information and you need it, the recovery.log file can be found in the Db directory in the LNS database location. Make changes to the drawing if necessary until it matches the physical network.

22. Compare the recovered database to your expected results. The recovery process will not make any changes to the configuration of your devices, even if changes are required. Any required changes are stored in the LonMaker network design, but are not written to the devices because the recovery process occurs in an OffNet management mode. Once you have validated your recovered LonMaker network design, change the management mode to OnNet in Network Properties. If any changes to device configuration are required, the LonMaker tool will prompt you to resynchronize the devices to the LNS database. If prompted, perform this resynchronization. For more information on this process, see Chapter 6, *Maintaining Networks*.

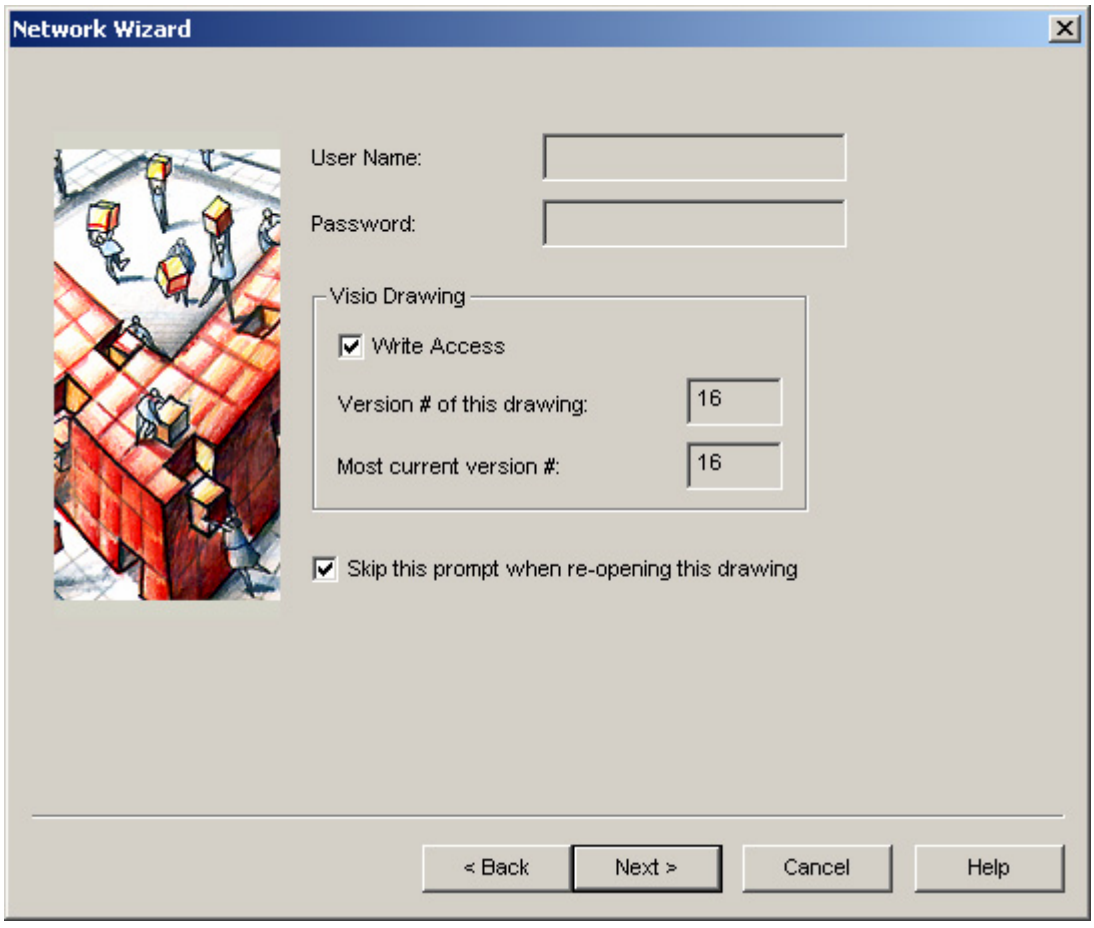
Opening an Existing LonMaker Network Design

You can open an existing LonMaker network design. If you plan on attaching to a network for the network design, you must define and configure your network interface before starting the LonMaker tool as described in *Setting up a Network Interface*, earlier in this chapter

You may open multiple LonMaker network designs by repeating the steps below as many times as necessary to open all the network designs that you wish to open. Each network design that you open will open its own instance of Visio.

To open an existing LonMaker network, follow these steps:

1. Open the Windows **Start** menu, point to **Programs**, then point to **LonMaker for Windows**. The LonMaker Design Manager appears.
2. Choose the network you wish to open. Enter the directory containing your drawing directories in **Drawing Base Path**. Then choose the correct drawing directories from **Drawing Directory**. Make sure the drawing you want to open is selected in **Drawing Name**. For a network with multiple drawings files, you can specify any of the drawing files associated with the network. Click **Open Network**. If you are opening a network on a remote client, see *Using the LonMaker Tool Remotely* for more information.
3. A warning may appear asking you if you want to enable macros. You must enable macros to use the LonMaker tool. You can set the option to trust all content from Echelon to disable the warning.
4. Visio starts and the selected LonMaker drawing file opens. The Network Interface window appears unless **Skip this Prompt** was set. Set **Network Attached** if the computer is attached to the physical network and you wish to communicate with the physical devices. If this option is selected and you have more than one network interface in your computer, select the name of the LNS network interface in **Network Interface Name**. Click **Next**. The User Logon window appears.



This window allows you to enter a User Name and Password, if necessary. It also displays the version number of the drawing, and the most current version of the network database. The version of the drawing and database are incremented each time the network design is saved. If the **Version # of this Drawing** value does not match the **Most Current Version #** value,

the network drawing is out of sync with the network database. These can be resynchronized as described in *Resynchronizing the Drawing, Database, and Network* in Chapter 6.

Note: You can open a LonMaker drawing directly from Visio. However, if you are using Windows XP or Windows 2000 and you log on as a user other the one who installed the LonMaker software, you must use the Design Manager to create or open a network at least once before opening a drawing directly from Visio.

5. If user profiles have been defined for this network, enter your user name and password as described in *User Profiles*. Otherwise, these fields are disabled.
6. Set **Write Access** if you want write access to the network drawings. This option does not override the privileges set in the user profiles. (See *Giving Users Write Access to LonMaker Drawings*.) A user who does not have write access in the user profiles cannot use this option to make changes to the LonMaker drawing. Click **Next**.
7. The OnNet/OffNet window appears unless you are not attached to the network or the **Skip this Prompt** checkbox was set. This window allows you to determine whether the LonMaker tool will be OnNet or OffNet when the drawing is opened. If the LonMaker tool is OnNet, all changes to the LonMaker drawing will immediately be propagated to the physical devices on the network; you can see the effect of every change made to the physical devices as they are made. If the LonMaker tool is OffNet, configuration changes to the LonMaker drawing will not be propagated to the physical devices until the LonMaker tool is placed OnNet, at which point all changes made while OffNet will be propagated. However, after devices have been commissioned while OnNet, network variable changes will be propagated to the network while OffNet. Click **Next**.
8. The Plug-in Registration window appears unless the **Skip this Prompt** checkbox was set. This window allows you to choose which plug-ins to register for this network. Plug-ins are LNS applications that can be started from within the LonMaker tool to perform a specialized task, often relating to a specific type of physical device or functional block. For example, the LonPoint plug-in provides specific user interfaces for reading and setting the configuration properties on LonPoint functional blocks. Other device manufacturers may provide plug-ins you can use to configure their devices. The **To Be Registered** list contains the plug-ins that will be registered for use with this network. See *LNS Plug-Ins* for more information on using plug-ins with the LonMaker tool.
9. You may add or remove plug-ins from the **To Be Registered** list using the **Add**, **Remove**, **Add All**, and **Remove All** buttons or by double-clicking the plug-in to be added or removed.
10. Click **Finish**. Changes are applied and selected plug-ins are registered.

    If you used any application other than the LonMaker tool to upgrade devices or modify this drawing before opening it, *resynchronize the drawing* to synchronize it with its associated LNS network database.

Opening a Copy of an Existing LonMaker Network

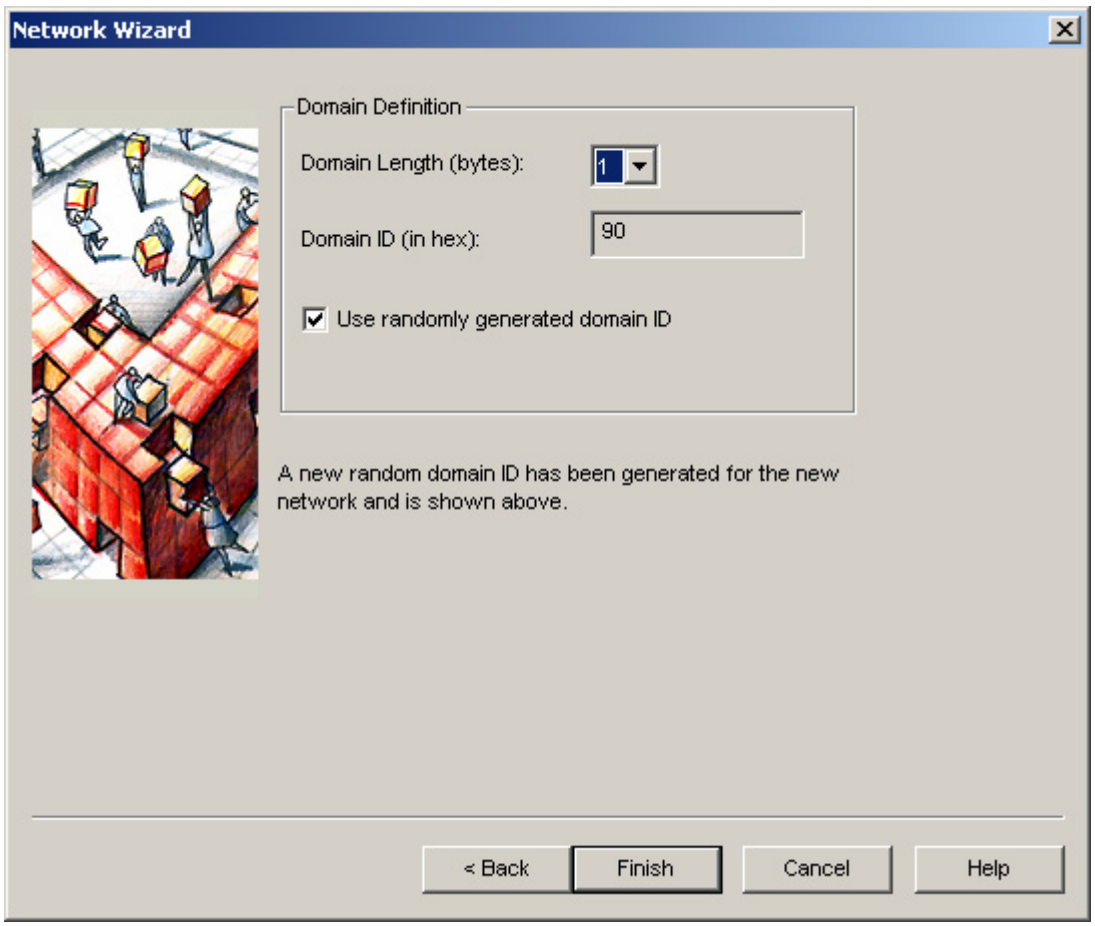
You can create a new LonMaker network by making a copy of an existing LonMaker network. Use this feature to reuse the same drawings, options, plug-ins, master shapes, and device templates from an existing network on a new network.

Creating a copy of an existing network speeds up the network creation process by using already registered plug-ins. If you need to create multiple networks that all use the same plug-ins, first create a new network with the plug-ins you need, then open copies of that network.

To copy a LonMaker network, you must be running the LonMaker tool on the computer running the LNS Server. If you are using a remote client, you can open an existing network, but you cannot create or copy a LonMaker network.

To open a copy of a LonMaker network, follow these steps:

1. Select **LonMaker for Windows** from the Windows **Start** menu. The LonMaker Design Manager appears.
2. Choose the network you want to copy. Enter the directory containing the drawing directories in **Drawing Base Path**. Then choose the correct drawing directory from the **Drawing Directory** list. Make sure the drawing you want to open is selected in the **Drawing Name** list. Click **Open Copy**. A confirmation dialog appears, followed by the Network Wizard. (See *Creating a LonMaker Network Design* for a complete description of the Network Wizard.)
3. Follow steps 5 through 10 in *Creating a LonMaker Network Design*. All the options you used in the old network will be selected. You can change any options you choose. When you have completed the Plug-In Registration window, click **Next**. The Network Properties: Domain window appears.



4. A new random domain ID is generated. If you want to use a specific domain ID, clear **Use Randomly Generated Domain ID** and enter your ID in **Domain ID**. Click **Finish**.

   If you are opening the copy of the network in the OnNet management mode, a window appears that indicates that you should not be connected to the original network. This window allows you to open the copied network either OnNet or OffNet.

   The LonMaker tool copies the LNS network database and LonMaker drawing to create the new network design. Any devices you created and commissioned in your original network will have the same Neuron IDs in the new (copied) network. To avoid conflicts, use a different domain or make sure you are not connected to the original network when you are using the copied network design.

The network copy will not have monitoring turned on, regardless of whether or not the original network had it turned on. Right-click a clear space in the drawing page and then click **Enable Monitoring** on the shortcut menu to begin monitoring. See *Monitoring and Controlling*, for more information.

Using a Local Client

You can use the LonMaker tool on the same computer with the LNS Server. This is called *local* operation and the LonMaker tool is called a *local client*. Some network interfaces such as the i.LON 10 Internet Server, i.LON 100 Internet Server, SLTA-10 serial interface, and the PL-SLTA serial interface allow the LonMaker computer to be physically remote from the network. In this case, the LonMaker tool is still running as a local client if the LNS Server is on the same computer, even if the computer is physically remote from the network. The following figure illustrates a typical local client.

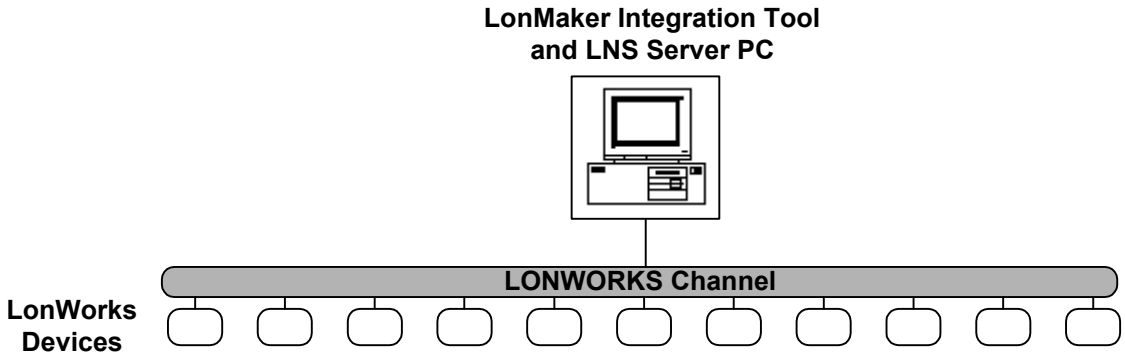


Figure 3 Local Client

In this configuration, the LonMaker computer contains an LNS network interface that is used to communicate directly with the physical network.

An alternate configuration for a local client is as a local IP client using an i.LON 1000 Internet Server. This configuration is shown in the following figure:

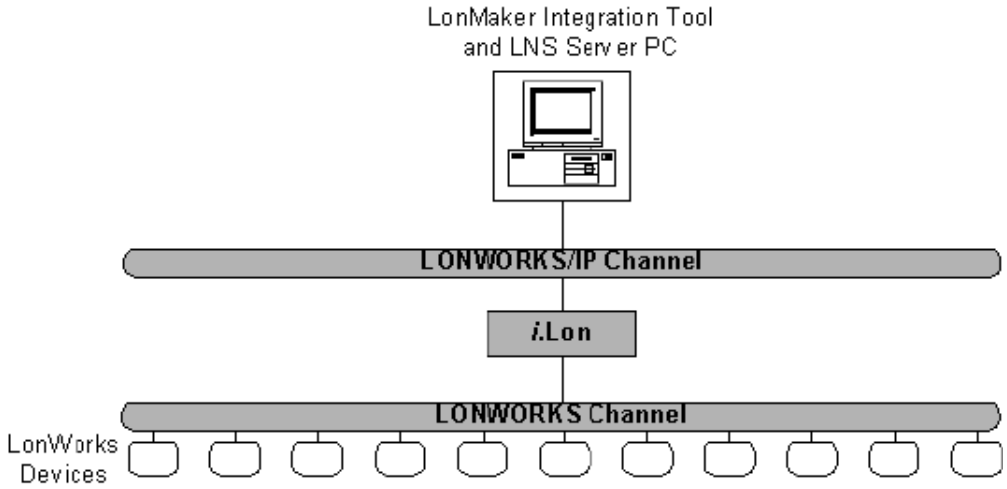


Figure 4 Local Client as Local IP Client

The *i*.LON 1000 Internet Server, when used as a router, allows a LonWorks/IP channel to be connected to a LonWorks channel. Using the *i*.LON 1000 server, a local application can communicate with a LonWorks network using an IP network card. See the *i.LON 1000 Internet Server User's Guide* for more information about the *i*.LON 1000 server.

Using a Remote Client

You can use the LonMaker tool on computer that is not the same computer that hosts the LNS Server. This is called *remote* operation and the LonMaker tool running on the remote computer is called a *remote client*. There are two types of remote clients, as follows:

	Remote Full Client	**Remote Lightweight Client**
Description	Runs on a computer other than the LNS Server and is attached to a LONWORKS or LONWORKS/IP channel. You can perform the following functions: • Open and use a LonMaker network design (not create or copy). • Monitor and control the network without routing the requests through the LNS Server.	Runs on a computer other than the LNS Server and is attached to an LNS/IP channel. You can perform the following functions: • Open and use a LonMaker network design (not create or copy). • Monitor and control devices, but all network variable reads and writes are routed through the LNS Server. This routing creates a potential bottleneck in the LNS Server if there are multiple remote lightweight clients that are all doing monitoring and control of many points at the same time.
Channel	LONWORKS/IP channel or LONWORKS channel	LNS/IP channel
Software utility needed	*i*.LON Configuration Server Utility and LonWorks/IP Channels control panel application if using an IP channel	LNS Remote Client Utility

Large networks with multiple remote clients and multiple *i*.LON 1000 Internet Servers should always use remote full clients for best performance. For more details, see the *Remote Full Clients* and *Remote Lightweight Clients* sections.

You must define and configure your network interface before starting the LonMaker tool as a remote client as described in *Setting up a LONWORKS or LONWORKS/IP Network Interface*.

To start a remote client, first start the LNS Server as described in *Starting the LNS Server.* The LNS Server computer must be attached to a LONWORKS or LONWORKS/IP (such as the Internet or a local intranet) channel. The LonMaker tool running on a remote computer must also be connected to a LONWORKS, LONWORKS/IP, or LNS/IP channel with a communication path back to the LNS Server. To start a remote LonMaker tool, follow the procedure under *Using the LonMaker Tool on a Remote Full Client* or *Using the LonMaker Tool on a Remote Lightweight Client.* Remote operation can be used to support multiple LonMaker users on the same network as described in *Using the LonMaker Tool with Multiple Users*.

Remote Full Client

When a remote client is attached to a LONWORKS or LONWORKS/IP channel, it is called a *Remote Full Client*.

When the LonMaker tool is a remote full client, it can directly monitor and control the devices on the network without routing the requests through the LNS Server.

There are a number of ways a remote full client can be connected to the LNS Server; the simplest is by connecting directly to a LONWORKS network using an LNS network interface, as shown in the following figure:

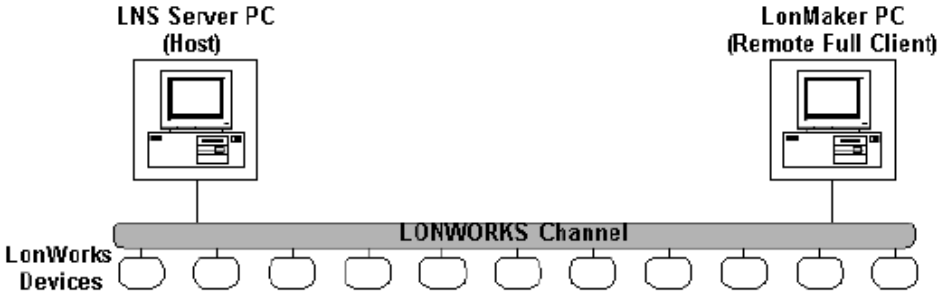


Figure 5 Remote Full Client and LNS Server on a LONWORKS Channel

The LNS Server computer and the LonMaker computer may be on different channels. Different channels must be connected by routers. LONWORKS and LONWORKS/IP channels must be connected by LONWORKS/IP routers, such as the *i*.LON 1000 Internet Server. The following figures illustrate two configurations with two channels—one LONWORKS channel and one LONWORKS/IP channel.

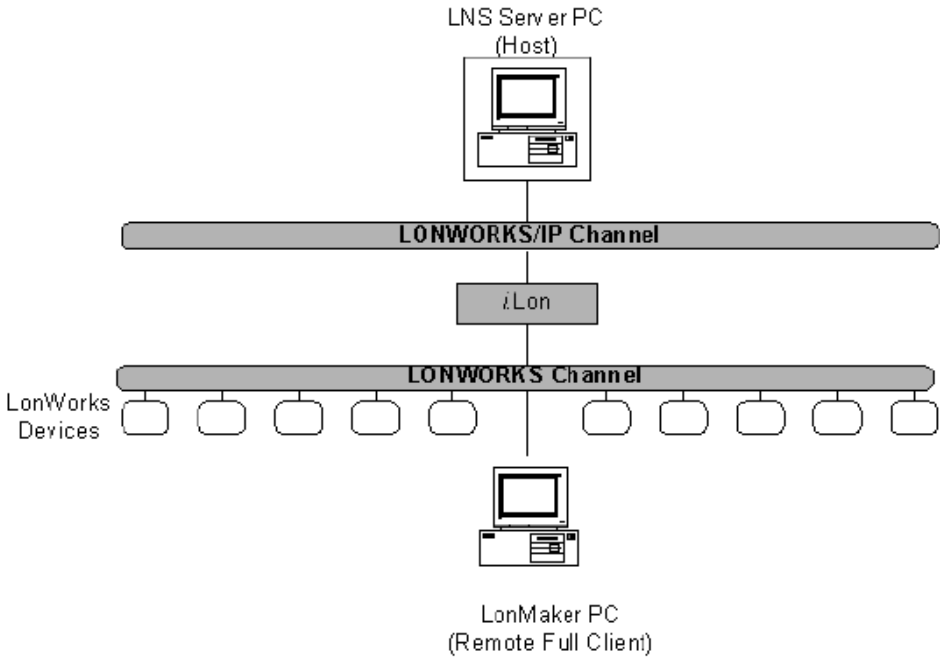


Figure 6 Remote Full Client with LNS Server Computer Attached to LONWORKS/IP Channel

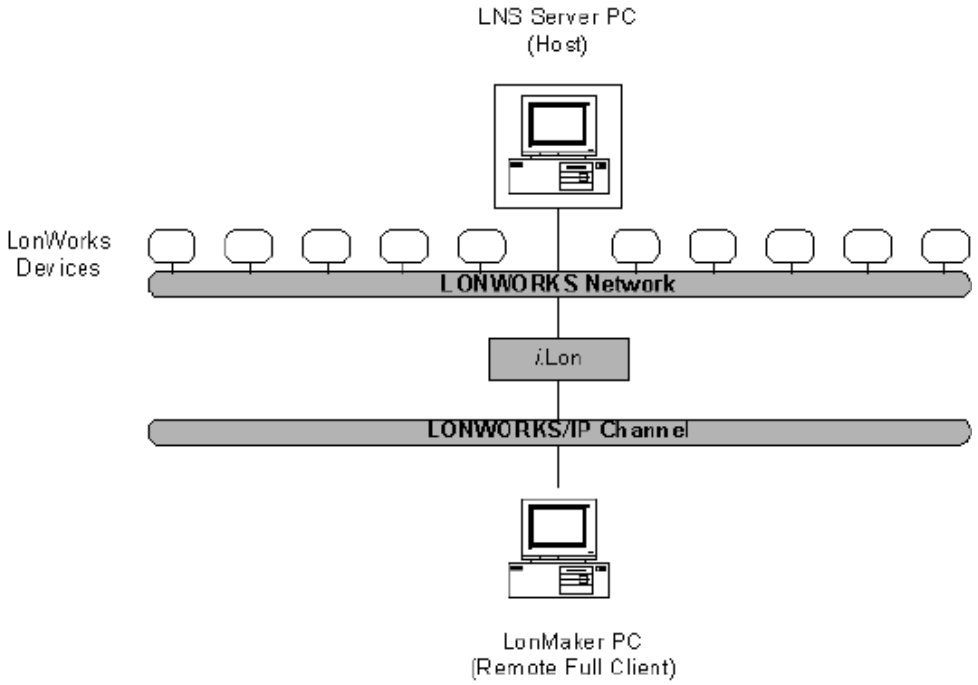


Figure 7 Remote Full Client with LonMaker Computer Attached to LONWORKS/IP Channel

The above configurations may be expanded to multiple channels and multiple remote clients. The LNS Server and remote clients may be attached to any of the channels. The following figure illustrates one example:

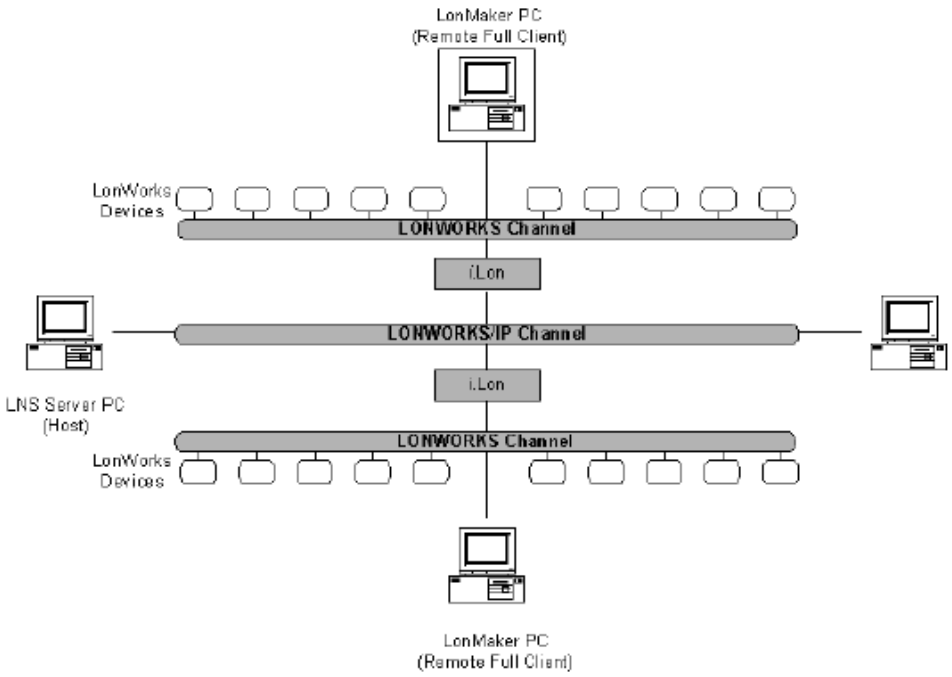


Figure 8 Remote Full Client with LonMaker Computer and LNS Server Computer Attached to Different LONWORKS Channels

Remote Lightweight Client

When a remote client is attached to an LNS/IP channel (not a LONWORKS/IP channel), as shown in the following diagram, it is called a *Remote Lightweight Client*. The LNS Server computer must be attached to the LNS/IP channel to support lightweight clients, and must also be attached to a LONWORKS channel as shown in the following figure.

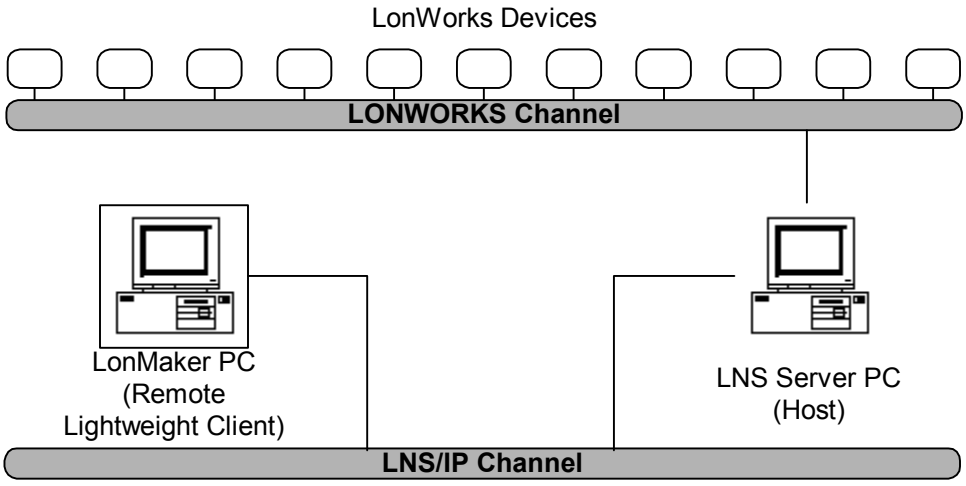


Figure 9 Remote Lightweight Client with LonMaker Computer and LNS Server Computer Attached to the Same LNS/IP Channel

LONWORKS/IP routers are not required for remote lightweight clients if the LNS Server computer is attached to a LONWORKS channel and all LONWORKS channels in the network are connected to this channel with LONWORKS routers.

Starting the LNS Server

Preparing for Remote Operation

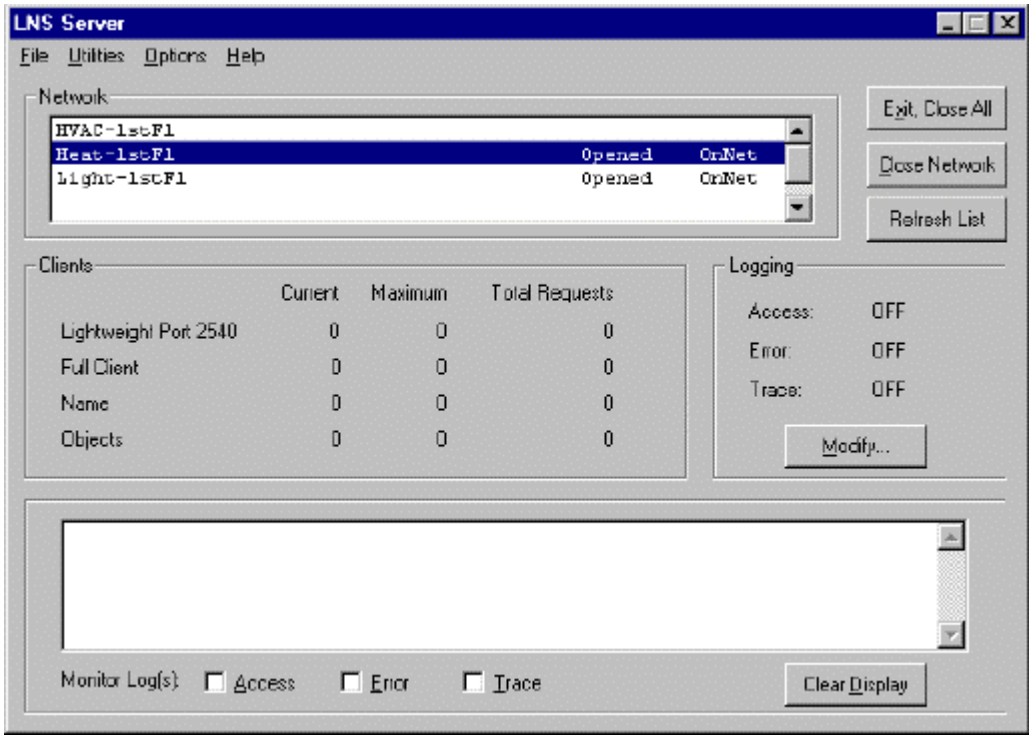
Before starting the LNS Server, complete the following steps:

1. Copy any custom stencils that you will need on the remote clients to the LonMaker drawing folder on the LNS Server computer.
2. Back up the LonMaker drawing for the network you will be accessing on the remote clients. See *Backing up a LonMaker Network* for instructions. Be sure to backup the drawing and all files in the drawing directory.
3. Save the LonMaker backup file to a shared network folder. If you do not have a shared network folder, save the backup file to a floppy disk or other removable media.

Starting the LNS Server

To start the LNS Server, follow these steps:

1. Open the Windows **Start** menu and select **LonMaker for Windows**. The LonMaker Design Manager appears.
2. Choose the LNS network database you want to open from the **Database Name** list and click **Launch LNS Server**. The LNS Server window appears.



The LNS Server window displays status information for the open network. You can minimize this window for convenience. Open the LNS Server help file by selecting *LNS Server Help* from the Help menu for more information on using the LNS Server.

Starting Multiple Networks

To start multiple networks, complete the following steps:

1. Click **Launch LNS Server** on the LonMaker Design window. The LNS Server window appears.
2. Highlight the second network you wish to open.
3. Click **Open Network**. The Network Interface dialog appears.
4. Select the network interface. Click **OK**.
5. Repeat this process until all networks have been selected.

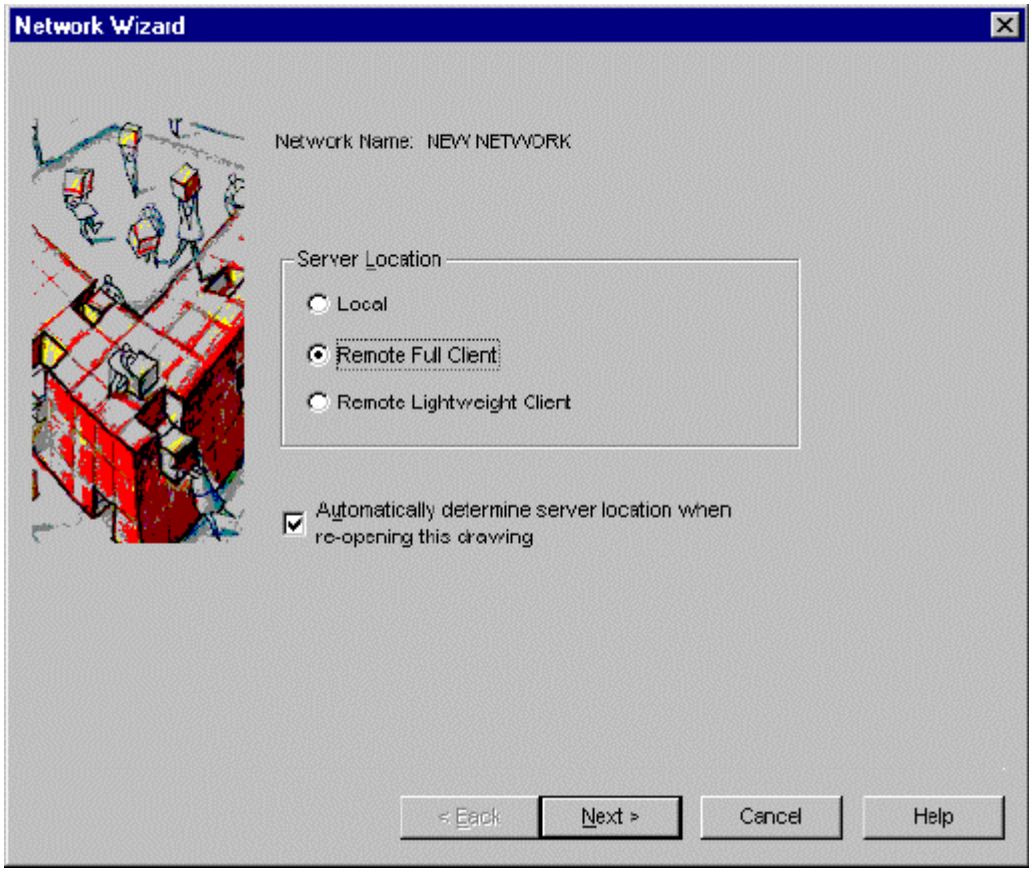
Using the LonMaker Tool on a Remote Full Client

When you are accessing the LNS Server computer as a *remote full client*, the client and server are on different computers. Each computer is attached to either a LONWORKS or LONWORKS/IP channel. A computer is attached to a LONWORKS channel using either an LNS Network Interface or an LNS Fast Network Interface. A computer on a LONWORKS/IP channel is attached using an IP network interface, such as an Ethernet network interface card (NIC) or a modem with PPP software.

The network interface to the LONWORKS or LONWORKS/IP channel must be defined and configured before opening an existing LonMaker network on a remote computer. If it has not been done, see *Using the LonMaker Tool Remotely* for more information.

To open an existing LonMaker network on a remote computer connected to a LONWORKS network, follow these steps:

1. Copy the LonMaker backup file that you created in step 2 of *Preparing for Remote Operation* in *Starting the LNS Server* to the remote client computer.
2. Start the LonMaker tool on the remote client computer. The LonMaker Design Manager appears.
3. Restore the LonMaker drawings you want to access. See *Restoring a LonMaker Network* for instructions.
4. If you don't choose to open a LonMaker drawing at the end of the restore process, see *Opening an Existing LonMaker Network* for instructions on opening the drawings.
5. A window appears, asking if you want to import the database or access the network as a remote full client or a remote lightweight client. Select **Remote Full Client**.



Click **Next**. The Network Interface window appears.

6. Select the correct **Network Interface Name** and make sure the network is attached to your computer. This window contains an additional checkbox called **Force LNS Server to be OnNet**. Remote full clients cannot log on with the LNS Server OffNet. However, if there are no pending updates, the LNS Server will automatically go OnNet to allow the LNS network interface to be added. Normally, if there are pending updates and the LNS Server is OffNet, the LNS Network Interface add will fail. Setting this option enables the LNS network interface add in this case, but will also cause all other pending updates to be performed.

   Click **Next**. The *User Logon* window appears.

7. If the network administrator has configured user names and passwords, login with your user name and password. Make sure they match your user name and password on the server. If you want write access to the drawing, set **Write Access**. Click **Next**.

   Note: If you set the **Write Access** checkbox and another user accessing the drawing already has write access to the drawing, the LonMaker tool displays a warning message. Do not continue until you can update your copy of the LonMaker drawing with the changes made by the previous user, and you are the only user with write access for the drawing. See *Giving Users Write Access to LonMaker Drawings*.

   The Management Mode window appears.

8. Choose whether you want the network to be OnNet or OffNet. When you work OnNet, the LNS Server interacts with the physical network and changes devices as you change them in the LonMaker network design. When you work OffNet, the LNS Server can browse and test

the devices on the physical network, but it will not make changes to the configuration of any devices.

Click **Next** after you have selected OnNet or OffNet. The Plug-in Registration window appears.

9. Any plug-ins registered for the server are already registered for clients as well. If you want to use plug-ins on a remote computer, make sure you have installed the plug-in executables on the remote computer. You can register additional plug-ins at this time by clicking **Add**. Click **Finish**.

You can now use the LonMaker tool in the same way you use it on the computer running the LNS Server. You can set many LonMaker options separately on the server computer and any remote clients. Using this feature, you can use LonMaker drawings with different option settings on different computers. For example, one user may have the **Enable Monitoring** option set while another user does not.

Using the LonMaker Tool on a Remote Lightweight Client

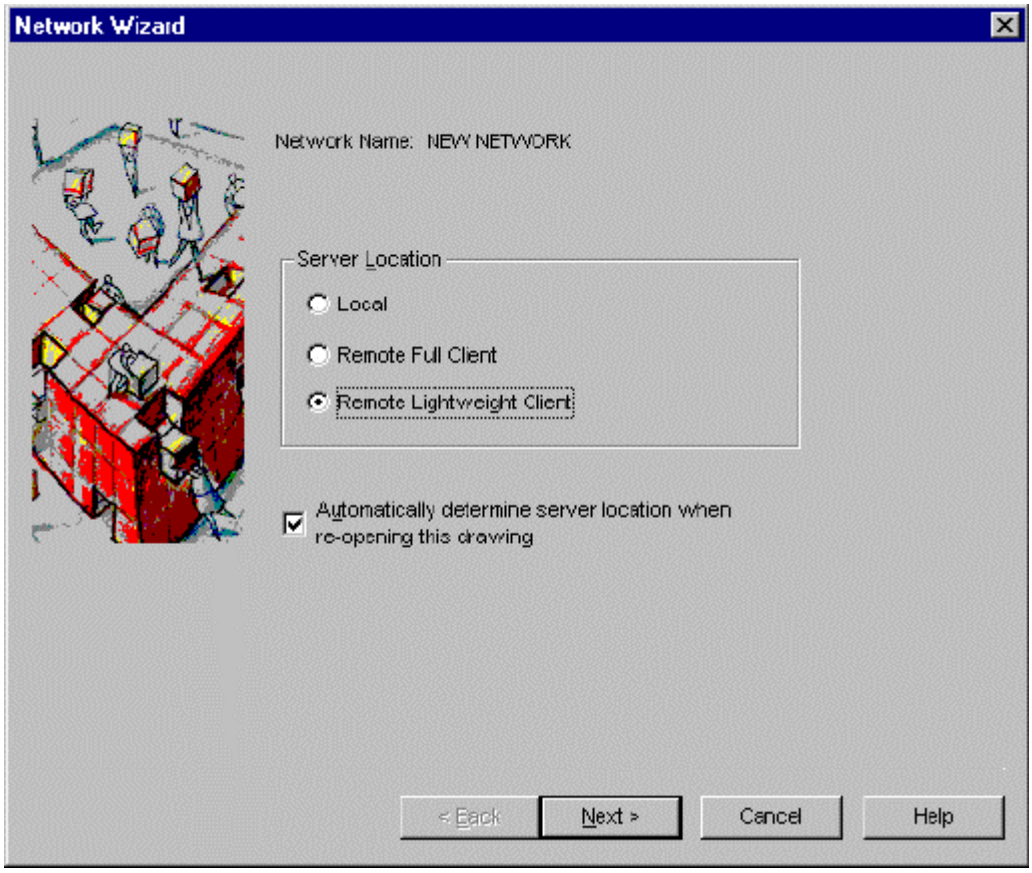
When you are accessing the LNS Server computer as a *remote lightweight client*, the LNS Server computer is attached to an LNS/IP (such as the Internet or a local intranet) channel. The LonMaker tool running on the remote computer communicates with the LNS Server over an IP network, using LNS packets contained within TCP/IP packets. Therefore, this channel is called an *LNS/IP* channel.

The network interface to the LNS/IP channel must be defined and configured before opening an existing LonMaker network on a remote computer. If it has not been done, see *Using the LonMaker Tool Remotely* for more information.

To open an existing LonMaker network on a remote computer connected to an LNS/IP network, follow these steps:

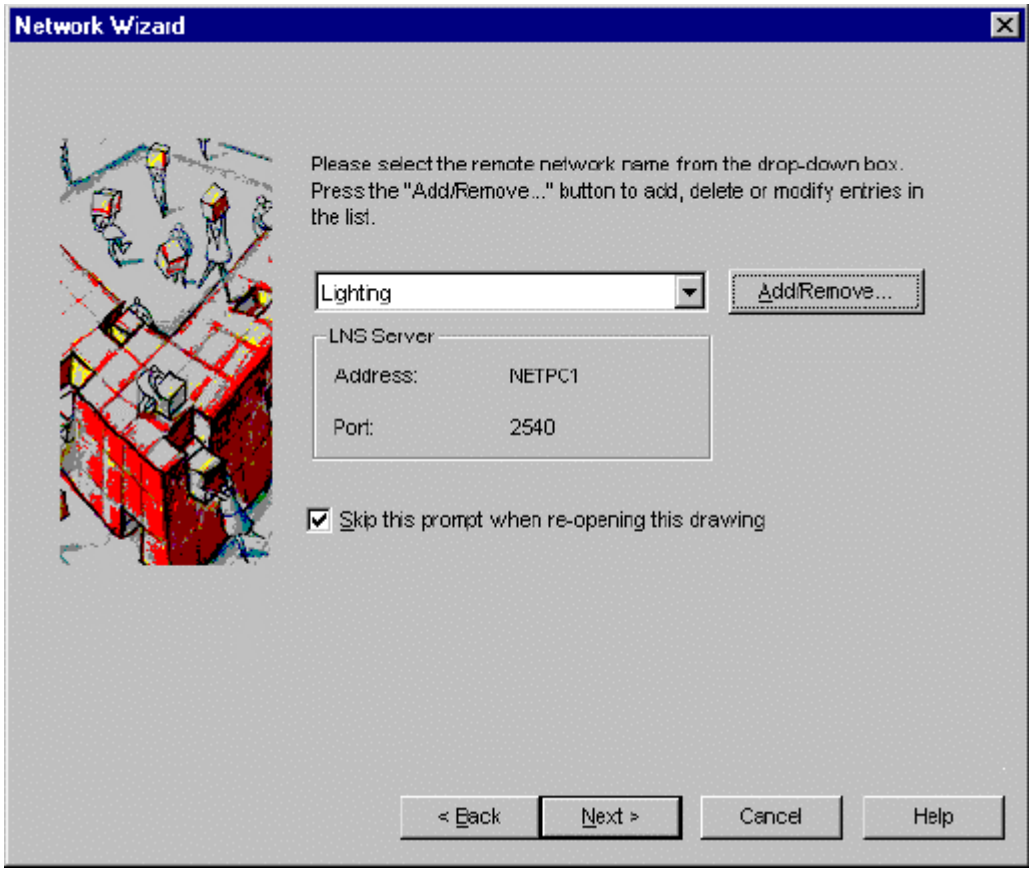
1. Copy the LonMaker backup file that you created in step 2 of *Preparing for Remote Operation* in *Starting the LNS Server* to the remote client computer.
2. Start the LonMaker tool on the remote client computer. The LonMaker Design Manager appears.
3. *Restore* the LonMaker drawings you want to access.

   If you don't choose to open a LonMaker drawing at the end of the restore process, see *Opening an Existing LonMaker Network* for instructions on opening the drawings.
4. A window appears, asking if you want to import the database or access the network as a remote full client, or a remote lightweight client.

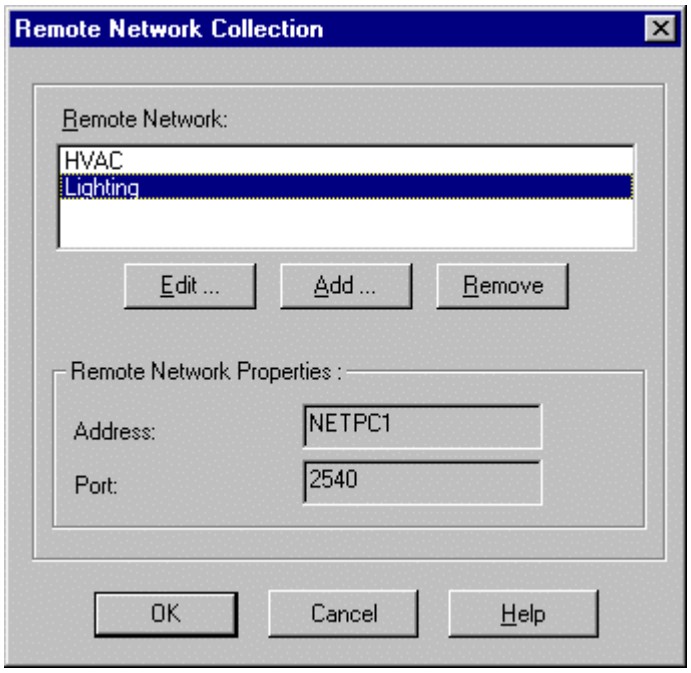


Select **Remote Lightweight Client** and click **Next**.

If the server address is configured correctly, the User Logon will open as described in Step 8. If there is a problem with the server address, or you are opening a drawing created using LonMaker 1.0, the Selecting a Remote Network Name window appears.



5. Select the network to connect to. If a connection to this network has already been established, select the network name, click `Next`, and skip to Step 8. If this is the first time you are accessing this network over an LNS/IP connection, click **Add/Remove**. The Remote Networks Collection dialog appears.



6. Click **Add** or **Edit**.

   This dialog allows you to create a new LNS/IP interface or modify an existing LNS/IP interface from this LNS/IP client. This dialog contains the following properties:

Remote Network	The name of the Remote Network that will appear in the Remote Network Connection dialog. This name does not need to match the name of the network.
Address	The address of the LNS Server for the network. See your network administrator for help finding the IP address of the computer running the LNS Server.
Port	The port to which the LNS/IP connection will be made. The default is 2540, which is the default port for the *LNS Server*.

7. Click **OK** to add the new LNS/IP interface to the Remote Network Collection dialog. Click **OK** in this dialog to return to the Remote IP Network Name dialog. Select the newly created network name and click **Next**. The User Logon window opens.

8. If the network administrator has configured user names and passwords, login with your user name and password. Make sure they match your user name and password on the server. If you want write access to the drawing, set **Write Access**. Click **Next**. The OnNet/OffNet dialog appears.

   If you set **Write Access** and another user accessing the drawing already has write access to the drawing, the LonMaker tool displays a warning message. Do not continue until you can update your copy of the LonMaker drawing with the changes made by the previous user, and you are the only user with **Write Access** set for the drawing. See *Giving Users Write Access to LonMaker Drawings*.

9. Choose whether you want the network to be `OnNet` or `OffNet`. See Appendix D, *Glossary* for more information. Click **Next**. The Plug-in Registration dialog appears.

10. Any plug-ins registered for the server are already registered for clients as well. If you want to use plug-ins on a remote computer, make sure you have installed the plug-in executables on the remote computer. You can register additional plug-ins at this time. Click **Finish**.

Using the remote lightweight client features, you can use LonMaker drawings with different option settings on different computers. For example, one user may have the **Enable Monitoring** option set while another user does not.

Computers acting as servers for lightweight clients should not be allowed to go into low power mode when the connection is idle. It may disrupt the connection.

Using the LonMaker Tool with Multiple Users

Multiple users may run LonMaker tools on multiple computers and remotely access the same LNS Server. Remote users may use any combination of LONWORKS, LONWORKS/IP, or LNS/IP network access. This is useful for large systems where multiple installers may be commissioning devices in different parts of the network at the same time. Installers may be isolated from each other by creating a subsystem within the top-level subsystem for each installer, and by giving each installer limited access to only their subsystem as described in *User Profiles*. For example, a system that is to be installed by separate HVAC, lighting, and security installers may contain HVAC, Lighting, and Security subsystems within the top-level subsystem. User profiles may be created for each installer that allow them to view the entire LonMaker drawing, but only modify their respective subsystem.

When multiple installers are working with the same LonMaker drawing, only one installer should be given write access at a time as described under *Giving Users Write-Access to LonMaker Drawings*. Write access is not required to commission, browse, configure, test, or manage devices. It is only required to make changes to the LonMaker drawing such as adding new devices, functional blocks, or connections. When an installer updates a LonMaker drawing, the changed drawing should be distributed to all other installers. This is simplified by maintaining a central repository containing a LonMaker backup file containing drawings only. This repository would typically reside on the computer running the LNS Server. When an installer updates a drawing file, the installer can create a new LonMaker backup file and copy it to the repository for access by all other installers. If the installers are all connected to an IP channel, the LonMaker backup file can be copied to and from the repository via IP. In the example above, the HVAC, Lighting, and Security subsystems are each created in a separate drawing file, but are saved in a single LonMaker backup file. The repository would maintain the current backup file.

A very large network may be initially created and installed as a number of smaller networks to significantly reduce the installation time. Each of the smaller networks may be installed simultaneously by an independent installer and after the initial installations and checkouts are completed, the smaller networks can be merged into a single large network as described in *Merging LonMaker Networks*. For example, each floor of a building may be initially created as an independent network. After each floor is checked out, it may be merged with the other floors to create a single larger network.

Giving Write-Access to LonMaker Drawings

The LonMaker tool supports a single writer to a LonMaker drawing at any one time. You can make changes to a LonMaker drawing if you have write access to the drawing and you select the **Write Access** option when you open the network. See *Opening an Existing LonMaker Network* for more information.

If you open a drawing and select the **Write Access** option, and another user with write access is already using the drawing, the LonMaker tool displays a warning message. Do not modify the drawing until you update it with the changes made by the other user and you are the only user with **Write Access** selected.

Write Access is selected by default when you open the drawing if no other user currently has write access to the drawing. If you open a drawing you do not need to modify, be sure to clear the **Write Access** checkbox if there are other remote users.

If more than one person needs to write to a drawing, each person must modify the drawing at a time when no one else is modifying the drawing. Use the following method to propagate the drawing from one user to another:

1. Once you have finished modifying a drawing, back up the LonMaker drawing only on your computer. Do not back up the database. See *Backing Up a LonMaker Network* for instructions.
2. Save the LonMaker backup file to a shared network folder. Or, if you do not have a shared network folder, save the backup file to a diskette other removable media.
3. Copy the backup file to all other clients and the server and restore the drawing on each. See *Restoring a LonMaker Network* for instructions.

The next user can now access the drawing with **Write Access** selected and modify the drawing. Alternatively, a large network may initially be installed as multiple independent small networks that are subsequently *merged into one large network*.

Though it is preferable to propagate drawings from one user to another, if you cannot do this you can use the **Resynchronize** command to synchronize a drawing with the database if drawings become out of synchronization due to multiple users.

If the LonMaker tool shuts down abnormally while a client has write access, attempts to re-open the LonMaker drawing with write access may result in a message indicating that another user is currently writing to this drawing. Ignore the warning message and open the drawing with write access. The write access state will be correct the next time you open the drawing.

Using LonMaker Backup Files

You can use the LonMaker Design Manager to save a LonMaker database and drawing to a single backup file with a .zip extension. You can use these backup files to protect against accidental file corruption, hardware failure, or to copy a LonMaker network from computer to computer. You can also use the backup files to archive a LonMaker network at sites without an LNS Server, or to archive multiple network configurations so a previous configuration can quickly be restored if necessary. A LonMaker backup file may optionally contain all files that you have placed in the LonMaker drawing directory, providing an easy way to back up and copy files associated with a LonMaker network such as HMI application files or schedule design files. When used with the NodeBuilder® tool, a LonMaker backup file may optionally include all project files. The following sections describe how to back up and restore a LonMaker network.

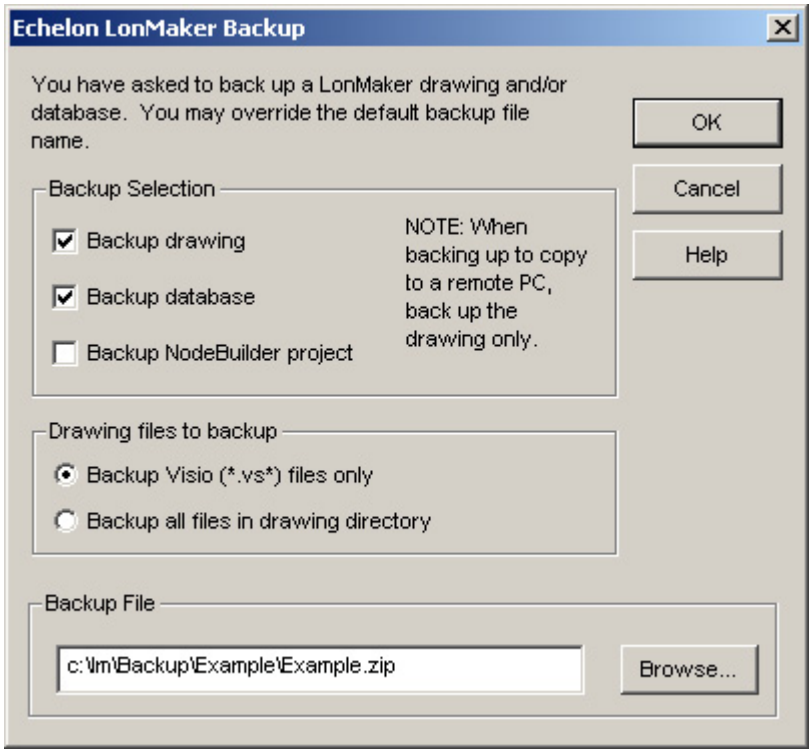
Backing Up a LonMaker Network

To back up a LonMaker network, follow these steps:

1. Close any plug-ins or other applications that have opened the LNS network database.
2. To back up an open LonMaker network, point to **LonMaker Documents** on the Visio **File** menu, then select **Backup**. The LonMaker tool automatically saves and closes the network, and displays the LonMaker for Windows Backup dialog. You cannot back up a network if other LNS applications have the same network open on the local computer. Proceed to step 4.

   To back up a LonMaker network that is not open in the LonMaker tool, exit any LNS applications that may be accessing the drawing or database. Open the Windows **Start** menu and choose **LonMaker for Windows**.

3. Select the LonMaker drawing and database you wish to back up in **Drawing Name** and **Database Name**. If your network contains multiple drawing files, select any of the drawing files. All drawing files in the network will be backed up regardless of which one you select.
4. Click **Backup**. If this LonMaker network has password protection (see *User Profiles*), you will be prompted for a user name and password. You must have the Modify privilege for the network object to back up a drawing or database. Once you have entered these, the following dialog appears.


Echelon LonMaker Backup
You have asked to back up a LonMaker drawing and/or database. You may override the default backup file name.
OK
Cancel
Help
Backup Selection
Backup drawing
Backup database
Backup NodeBuilder project
NOTE: When backing up to copy to a remote PC, back up the drawing only.
Drawing files to backup
Backup Visio (*.vs*) files only
Backup all files in drawing directory
Backup File
c:\lm\Backup\Example\Example.zip
Browse...

5. Choose which elements of the LonMaker network to back up. Set **Backup Database** to back up the LNS database. Set **Backup Drawing** to back up the LonMaker drawing. If this LonMaker network has a NodeBuilder project associated with it, set **Backup NodeBuilder Project** to backup the associated project. If you are backing up a network to be copied to a remote client, back up the drawing only.

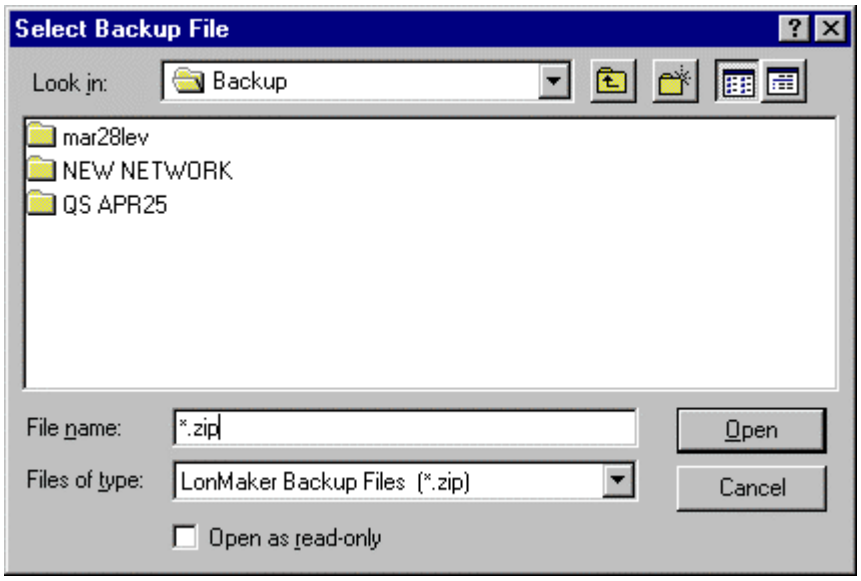
   Choose whether you want only Visio files in the drawing directory to be backed up or if you want all other files that you have placed in the drawing directory to be backed up as well. When backing up a LonMaker network, you should also backup any plug-ins, user resource files, and device interface (XIF) files used by the network. These can be placed in the drawing directory and automatically backed up using this option.

   The default backup directory is `\LM\Backup\<Network Name>` and the default backup file name is `<Network Name>.zip`. You may change this by changing the filename in **Backup File** or by clicking **Browse** to navigate to a different directory.
6. Click **OK**. All LonMaker network elements selected in the backup dialog will be archived into the specified file. When the backup is complete, the LonMaker tool confirms that the backup was successful.

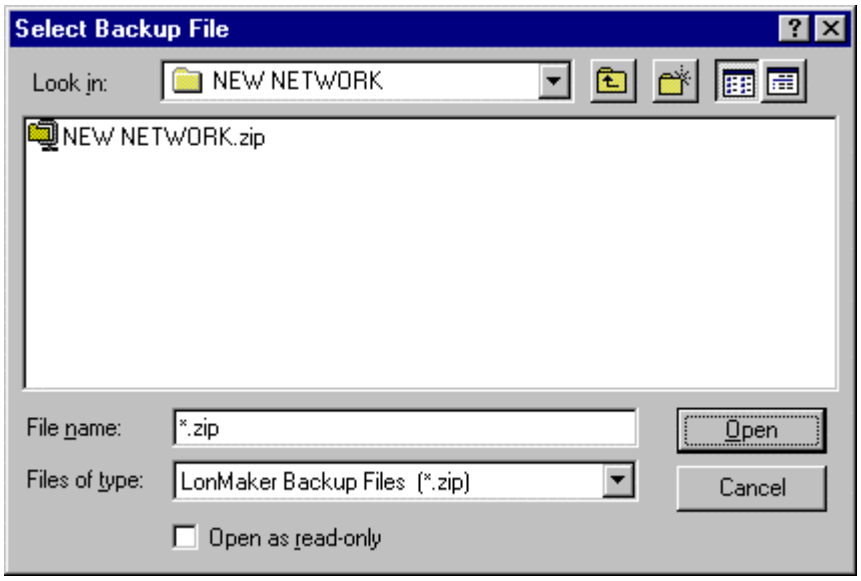
Restoring a LonMaker Network

You can restore a network drawing or database from a LonMaker backup file (see *Backing Up a LonMaker Network* for information on how to back up a network). To restore a backed-up LonMaker network, follow these steps:

1. Open the Windows **Start** menu and choose **LonMaker for Windows**.
2. Click **Restore**. The following window opens:

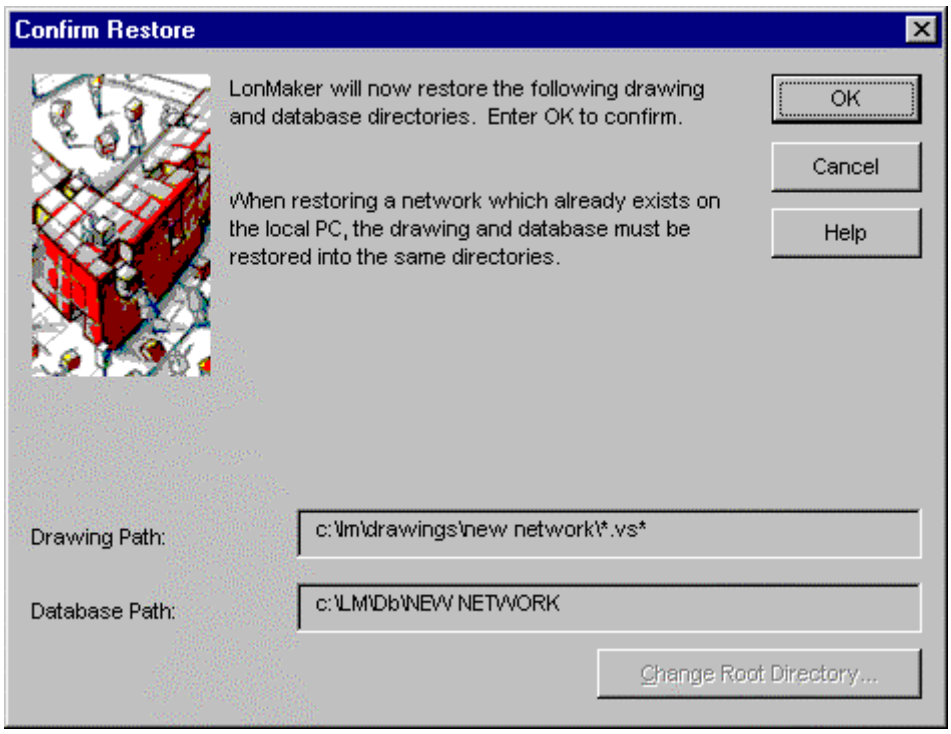


3. Select the directory containing the LonMaker backup file and click **Open**. The following window appears:



4. Select the LonMaker backup file. Click **Open**.

5. If this LonMaker network is password protected (see *User Profiles*), you will be prompted to enter your user name and password. You must have the Modify privilege on the network object to restore a network. The Confirm Restore window appears.


Confirm Restore
LonMaker will now restore the following drawing and database directories. Enter OK to confirm.
When restoring a network which already exists on the local PC, the drawing and database must be restored into the same directories.
OK
Cancel
Help
Drawing Path:
c:\lm\drawings\new network*.vs*
Database Path:
c:\LM\Db\NEW NETWORK
Change Root Directory...

6. This dialog shows the drawing path and database path to which the LonMaker network will be restored. You cannot change the directory if the database already exists on your computer. If you must change the directory in this case, delete the network first, and then restore the backup file. To change the drive or root directory, click **Change Directory** to browse to a new directory. For example, to restore the files in step 4 to `D:\Mynets`, click **Change Directory** and browse to `D:\Mynets`. The fields will now read:

```
Drawing Path:   D:\Mynets\lm\Drawings\Testnet\*.vsd

Database:       D:\Mynets\lm\Db\Testnet
```

Once you have specified the desired directory, click **OK**. The LonMaker tool will open the following dialog once the backup file has been restored.

Echelon LonMaker
The restore operation completed successfully. It is recommended that you recommission any devices which may have changed state since this backup was made. Would you like to open the drawing now to do this?
Yes
No

7. Click **Yes** to open the restored LonMaker drawing, or **No** to complete the restoration process without opening the drawing. Click **Yes** if any devices have been changed since the backup file was created. See *Recommissioning a Network* for more information. If the network drawing is restored to a computer with different fonts, or a different print output device, the

Visio drawing may look different. Text that all fit on one line may wrap, for example. If text wrapping is causing problems in the look of a shape, right click the shape and disable `Automatic Sizing`, then re-enable it to have Visio recalculate the size of the shape.

3

Designing Networks

This chapter provides information on designing networks, optimizing network performance, navigating the subsystem hierarchy, next steps, and controlling access with user profiles.

Design Overview

When planning a LonMaker network design, you must carefully examine all aspects of the network requirements up-front to ensure that those requirements are met after the network is installed. You should, for example, examine your present *networking requirements* to determine which channels, devices, and connections are needed to accomplish the tasks at hand. It is also important to consider ways to *optimize network performance*, especially if you are planning a large network. In addition, look at how the network will be installed: with a single computer and the database onsite, or a server with remote clients. Determine whether one person or multiple network designers and installers will work on the installation. Plan how to control multiple user access once the network is up-and-running. Finally, examine future network expansion and growth to ensure that the scope of the present network will not be a limitation in the future.

Designing LonMaker Networks

Before designing a network, you must determine your network requirements. To define requirements, answer these questions:

- What sensors, actuators, and controllers will be needed to accomplish the tasks that need to be done?
- What physical devices can be used to drive these sensors, actuators and controllers?
- Which devices will reside on which channels? For example, a simple fan coil unit may need a fan start/stop relay, a cooling coil valve, and a supply air temperature sensor. If you are using LonPoint devices, you could use one DO-10, one AO-10, and one AI-10 device to drive the necessary actuators and sensors. The AO-10 module includes a PID Controller you can use to control the fan coil unit.

Once you have defined your requirements, plan your network organization within the framework of the LonMaker tool. To plan your network, answer these questions:

- How will devices and functional blocks be organized within subsystems?
- What devices need to share information through network variables?
- How do the functional blocks need to be configured for them to correctly interpret values from sensors, perform any necessary calculations on these values, and drive actuators?

You must also determine if you will be connected to the physical network when designing it and use this information to determine the *Network Installation Scenario*. You may be away from the network doing network design as described under the *Engineered System Scenario*. Or, you may be attached to the network as described in the *Ad-hoc Scenario*, or for the commissioning and maintenance of an engineered system.

After you plan the requirements for your LonMaker network design, you can use the LonMaker tool to create it. To create a network using the LonMaker tool, you add *Device*, *Functional Block*, *Connection*, *Router*, *i.LON Server*, *Channel*, and *Subsystem* shapes to your drawing. You add these LonMaker shapes by dragging shapes from a LonMaker stencil to your LonMaker drawing. The LonMaker tool starts the appropriate wizard that guides you through the process of creating each object. The following sections provide an overview of the LonMaker Basic Shapes stencil, and then describe how to use each of the shapes.

You can add LonMaker shapes to your LonMaker drawing at any time. If the LonMaker tool is attached to the network and OnNet when you add LonMaker shapes, any changes that you make that affect device configuration are immediately written both to the LNS network database and to the physical devices. If the LonMaker tool is not attached or is OffNet, changes are only written to the LNS network database. These changes will be written to the devices the next time the LonMaker tool is attached to the network and OnNet.

Network Installation Scenarios

The steps that one follows to design and install a network are called the *installation scenario*. The scenario determines the network design and installation procedure. The best scenario for any given network depends on many factors, such as the skill level of the installer, the amount of flexibility desired, and the requirements of the end-user.

There are two general scenarios used when designing and installing a network using the LonMaker tool, the *engineered system scenario* and the *ad-hoc scenario*. These scenarios may be combined within a single system.

Engineered System Scenario

The e*ngineered system* installation scenario allows you to design the network without being connected to the physical network. You drag LonMaker shapes representing *devices*, *routers*, *functional blocks*, and *connections* from a LonMaker stencil to a LonMaker drawing and arrange them on the drawing and into multiple subsystems if desired.

Once the network is attached, you associate these shapes with the physical devices through a simple commissioning step that associates the LonMaker *device* and *router* shapes with the physical devices and loads the configuration information defined during network design into the devices and routers.

In real-world installations, engineered systems invariably must be modified during the on-site commissioning process due to differences between as-drawn plans and the physical network. The LonMaker tool supports on-site changes to the engineered system to allow for these changes during commissioning.

The advantage of the engineered system network design scenario is that, since most of the time-consuming data entry and processing is done off-site, the network commissioning on-site is very quick, easy, and error free. This scenario is often used for building and industrial automation systems where the original design closely matches the actual installation.

Ad-Hoc Scenario

In the *ad-hoc* installation scenario, you use the LonMaker tool to design and install the network on-site. In this scenario, the LonMaker tool loads the network configuration information into each device as you define devices, configuration, and connections. This is different from the engineered system scenario in that information is incrementally loaded to the physical devices.

This scenario has the advantage of offering the most flexibility by letting the installer make decisions on-site. It is most appropriate for simpler systems in which the details of the system to be installed are not known prior to commissioning.

This scenario has the disadvantages of being slower for large systems and of requiring the same person to do both design and commissioning.

Optimizing LonMaker Network Performance

Many factors affect the performance of the LonMaker network design. The following guidelines are key for optimizing performance for large and small networks alike. For large networks, following these guidelines can have a significant impact on LonMaker performance.

Using Multiple Drawing Files

To optimize performance, a single drawing file should not be larger than 3MB or consist of more than 20 typical pages or 10 complex pages. If you are creating a network that needs more complexity than this, design the subsystems in *multiple drawing files*. For optimum performance,

devices and their associated functional blocks should be contained within the same drawing file, as should all members of the same connection.

When designing multiple drawing files, organize the individual drawing files as subsystems within the top-level drawing file, and limit the top-level drawing to contain only those subsystems. This minimizes the number of drawing files that must be opened as you descend the subsystem hierarchy.

Avoid deep subsystem hierarchies with long subsystem names that results in long subsystem paths. This does not have a significant impact on performance, but visualization tools such as Wonderware InTouch have limits to item name lengths that can be exceeded with long subsystem paths.

Making Numerous Network Changes

When making many network changes at one time, first configure the LonMaker tool to be OffNet. While OffNet, the LonMaker tool does not propagate the changes to the physical devices after each modification. As a result, changes to the network can be made quickly. When you have completed the changes, configure the LonMaker tool to be OnNet. This sends updates of the changes to the physical devices, providing significantly improved performance over making the changes while OnNet.

Using Connections

When *creating connections* (especially when using reference connections), the hub network variable should be the one that is common to most of the connections. When dropping a connector shape, the end with the '**X**' is the hub, the end with the '+' is the target.

Limit connections monitored by the LonMaker tool to less than five per subsystem if you will be making any changes to the subsystem. More than five monitored connections in a subsystem will significantly increase the time it takes to perform certain network management operations. Alternatively, you can turn off all monitoring while making changes by right-clicking a clear space in the subsystem page and clearing the **Enable Monitoring** checkbox. You can turn monitoring on again after making the changes.

Non-persistent bound connections can significantly increase the time required to open and close a LonMaker drawing. These are not created by the LonMaker tool, but may be created in a LonMaker network by another LNS application. If you are using an LNS application that does not support monitor sets and you must create many bound connections, make them persistent to improve performance. If the LNS application, such as the LonMaker tool, supports monitor sets, it enables rapid monitoring setup of the monitor points (points in monitor sets are always persistent) when it opens the LonMaker drawing. The LonMaker tool automatically creates monitor sets for connection monitoring when monitoring is enabled on a LonMaker network. To enable monitoring, see *Monitoring Connections* in Chapter 10, *Monitoring and Controlling Devices*. For more information on monitor sets, see the LNS Programmer's Guide.

Sharing the LNS Interface with the LNS DDE Server

The LNS DDE Server and the LonMaker tool can run at the same time and share the same LNS network interface; however, LonMaker performance will be significantly degraded if the LNS DDE Server is polling more than 10 network variables per second on a LONWORKS 78 kbps to 1.25 Mbps channel. By default, the LNS DDE server will poll active network variables every 1 second, so more than 10 active network variables running at the default poll interval can impact LonMaker performance. You will see similar performance impacts if you have any other monitoring application sharing the LNS network interface with the LonMaker tool, or if you are using connection monitoring within the LonMaker tool. Polling continues even if the LonMaker tool is OffNet, and excessive polling can significantly increase the time to go OnNet. If you will be making extensive network modifications, either disable the LNS DDE Server and any other

LNS monitoring applications, or reduce the poll rates to for a total throughput of no more than 10 polls per second, while you are making the modifications.

Using Functional Blocks for Optimization

If you have a large network and you use functional blocks with many network variables that are not connected to other network variables, delete unused network variable shapes from the functional block shapes. Each network variable shape on a functional block adds a performance overhead, yet network variable shapes are not required on a functional block if they are not connected. You can add network variable shapes back to a functional block if you find that you need to connect them later. You can create functional block master shapes with your most commonly used network variables to simplify this optimization. See *Creating a Functional Block* in the *Creating Networks* chapter.

Using Subsystems for Optimization

Subsystems allow you to break a large network into more manageable parts. For example, in a building control network, one subsystem could contain lighting controls and another temperature controls. Each subsystem is represented by a page of a LonMaker drawing and by a subsystem shape on the drawing page containing the subsystem. Subsystems may be nested like directories on your computer, so the temperature control subsystem could contain other subsystems representing, for example, each floor of the building. You can also create subsystems in separate LonMaker drawings. Using this feature, you can create large networks while maximizing Visio's performance by limiting the number of pages in a single drawing. You can also create a separate LonMaker drawing for each user for large networks with multiple installers.

If you are creating a network that needs more subsystems than 20 typical pages or 10 complex pages, you should divide it into two or more drawing files. See *Creating a Subsystem* and *Using Multiple Drawing Files* for more information. For optimum performance, devices and their associated functional blocks should be contained within the same drawing file, as should all members of the same connection.

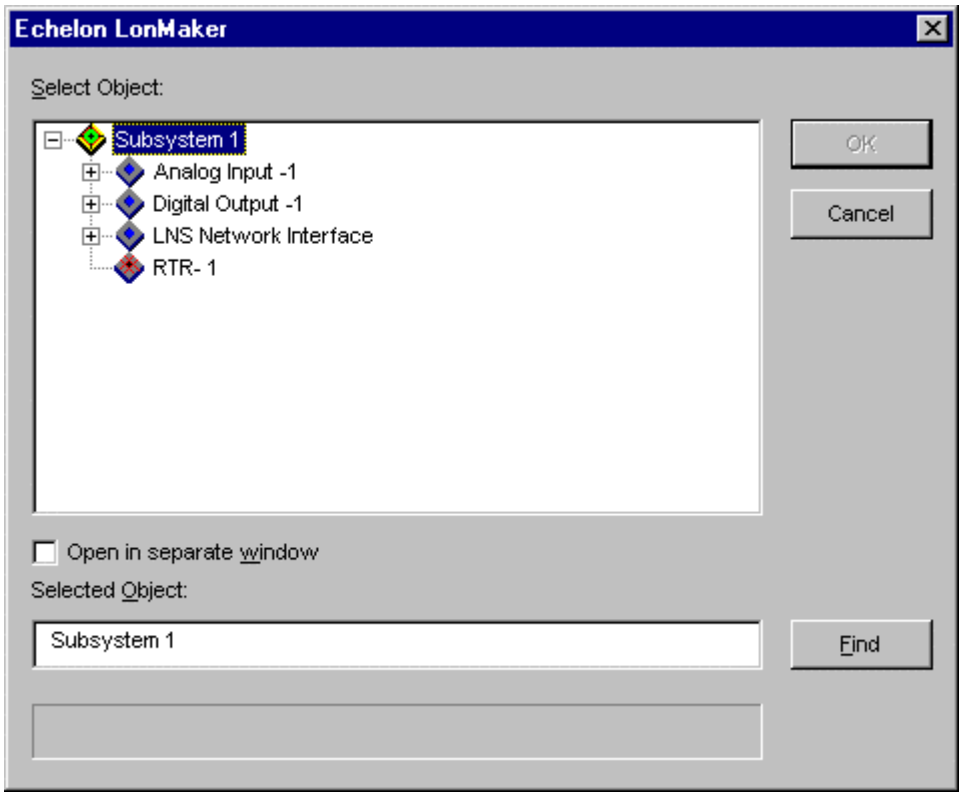
A *supernode* is a special type of subsystem shape that has one or more network variable interfaces on it. Any network variable or message tag on any functional block in the subsystem may be exported to the subsystem shape. This does not create new network variables or message tags, but exports the network variable or message tag's connection point one or more levels up the subsystem hierarchy. Using a supernode allows you to provide a simple interface to an arbitrarily complex subsystem. For example, a supernode that contains lighting controls may have a network variable interface that allows the devices contained within it to be put into emergency override. This allows the integrator to easily identify the critical interfaces into the subsystem while ignoring those that are typically only used internally by the subsystem.

Navigating the Subsystem Hierarchy

A Visio page represents each subsystem in a network. Each Visio window can have one page open at a time (although you may open multiple drawings or pages in multiple Visio windows). You can navigate through the subsystem hierarchy using any of the following methods:

- To open any item in *Network Explorer*, double-click that item and the subsystem page with the item selected is opened.
- To open a subsystem page in the current window, double-click a subsystem icon within *Network Explorer*. Or, double-click a subsystem shape. If the subsystem is a different drawing, it will appear in a new window.
- To open a subsystem page in a new window, Ctrl/double-click a subsystem icon within the *Network Explorer.*

- To go to the parent subsystem, double-click the subsystem name at the top middle of the page. The parent subsystem is opened in the same window unless it is contained in a different drawing, in which case it will be opened in a new window.
- To move up one level in the subsystem hierarchy and display the subsystem in the current window, right-click an empty spot in a subsystem and select *Go to Parent Subsystem* from the shortcut menu. The parent subsystem is opened in the same window unless it is contained in a different drawing, in which case it will be opened in a new window.
- To open the Choose Subsystem dialog, right-click an empty spot in a subsystem and then click **Go to Subsystem** on the shortcut menu.



- To open a dialog that will allow you to choose from all functional blocks on the device, right-click a device and then click **Go to Functional Block** on the shortcut menu. If the functional block is in a different subsystem from the device, the LonMaker tool opens the subsystem containing the functional block.
- To go to a device from a functional block, right-click a functional block and then click **Go to Device** on the shortcut menu. If the device is in a different subsystem from the functional block, the LonMaker tool opens the subsystem containing the device.
- To go to the other side of the reference connection, which may be in another subsystem (see *Using Reference Connections*), right-click a reference connection and then click **Go to Reference** on the shortcut menu

Navigating using the Network Explorer

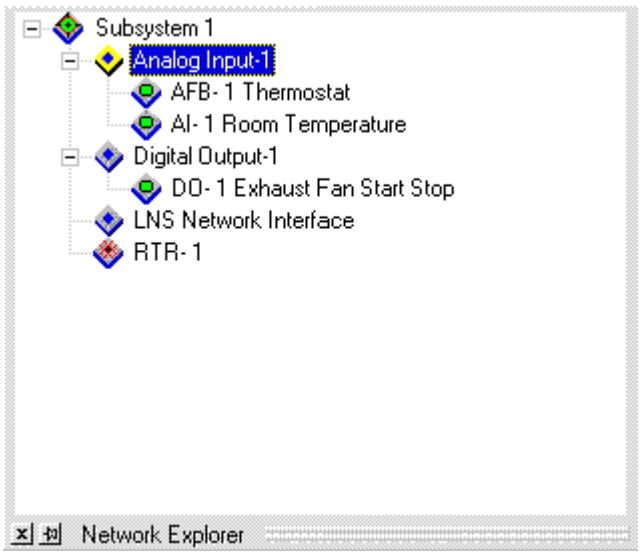
The LonMaker Network Explorer is an auto-hide window that displays a hierarchical view of your LonMaker network. It simplifies the task of navigating through a large LonMaker network by displaying the network as a single tree view containing subsystems, devices, and functional

blocks. The Network Explorer supports most commands that are available in LonMaker graphical views, providing the flexibility to either use the Network Explorer as a navigational aid, or as your primary interface to the LonMaker tool.

To display or hide the Network Explorer, open to the **View** menu, point to **Windows**, and then select **Network Explorer**.

To use the Network Explorer, right-click a subsystem, device, or functional block shape to view its shortcut menu.

You may also modify the default appearance of the Network Explorer and the type of objects displayed. To do so, select **Network Properties** on the **LonMaker** menu, click the LonMaker Options tab, and then select **Network Explorer**.



To find a subsystem, device, or functional block within a LonMaker drawing, browse through the Network Explorer to find the object, then double-click its icon. The appropriate LonMaker drawing will be opened to the location of the selected object.

Using Network Navigators

The network navigators can be used to expand, select items, and deselect items when configuring a LonMaker network. These controls are accessible when adding functional blocks or supernodes to a connection, selecting network variables to assign to a subsystem, and choosing the subsystem into which to replicate a connection.

The following commands are available in the network navigators:

Expand	Displays all descendents under the selected.
Select All	Expands the item and marks all of its descendents as selected. Only applies in cases that support selecting multiple objects.
Deselect All	Expands the item and deselects all of its previously selected descendents. Only applies in cases that support selecting multiple objects.

Controlling Access to LonMaker Network Designs

When you create a LonMaker network design, the LonMaker tool does not assign any security to the drawing. It defaults to one user, and this user is the administrator of the LonMaker drawing. While this default is fine if one person is performing the network installation in a secure environment, it may not be appropriate for insecure or multi-user environments.

When operating in insecure or multiple user situations, you may control access to the network and your LonMaker drawings. In an insecure environment, access control is needed to prevent unauthorized modification to your network, while in a multi-user situation, you may desire access control to better manage installation or repair efforts. In either case, the LonMaker tool provides you with the ability to control access to LonMaker drawings via the creation and management of user profiles.

User Profiles

User profiles allow you to create permissions that give different users different levels of read and write access to a LonMaker network. For example, a system integrator would have write-access to the entire network while an installer may have access only to push service pins to commission devices.

You might use a different user profiles scenario if you are working with multiple integrators, all of who are supplying devices for your network. In this case, you can give each integrator access only to the subsystems that he or she is installing. This prevents one integrator from accidentally modifying a drawing created by another integrator.

By default, user profiles are not enabled for new networks. To enable user profiles, you must first assign an Administrator password and create new user profiles as described in *Modifying User Profiles as the Administrator*. The Administrator can create, modify, and delete user profiles.

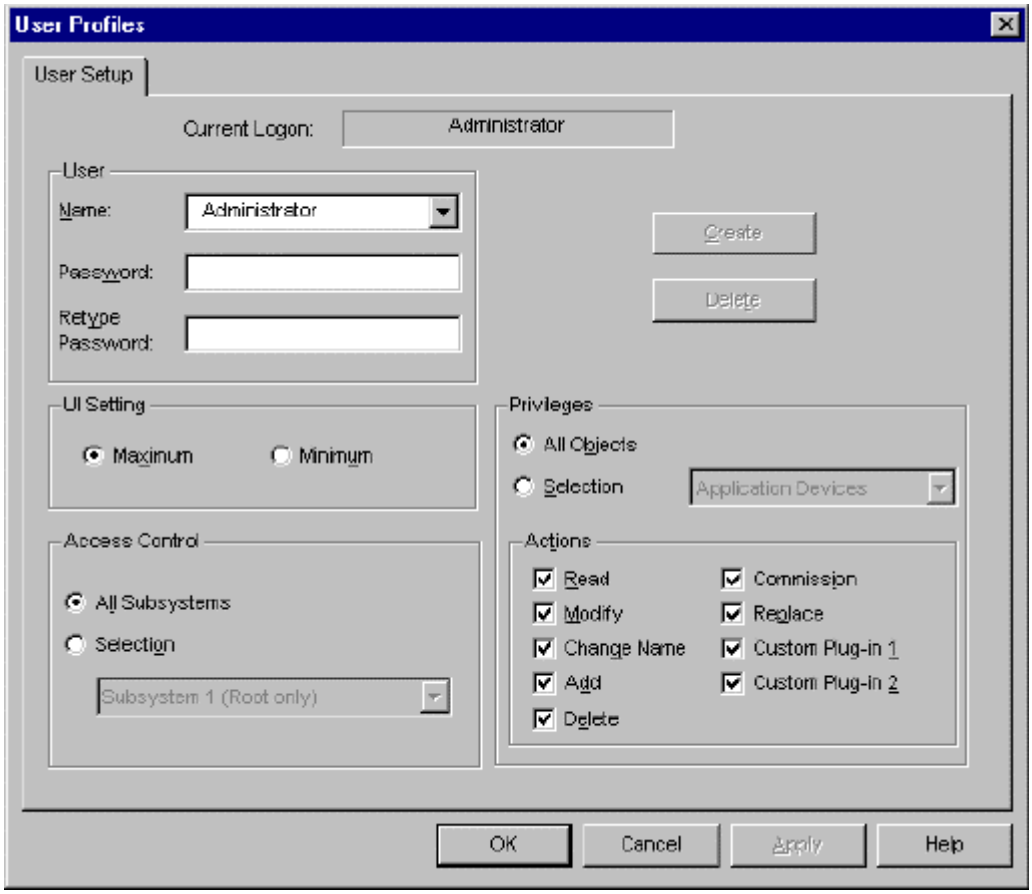
Once you logon as a user other than the Administrator, you can still create new user profiles, as described in *Creating a New User Profile* and change your password as described in *Changing Passwords*.

For information on using user profiles with LonMaker remotely, see *Using the LonMaker Tool Remotely with User Profiles*.

Modifying and Deleting User Profiles as the Administrator

To modify user profiles, follow these steps:

1. Select **User Profiles** from the **LonMaker** menu. The following User Profiles dialog appears:



2. If this is the first time you have created user profiles in this drawing, pick an Administrator password, enter it into **Password** and **Retype Password**, and then click **Apply** (this password is case sensitive).

3. You can now create new users. (You can create new users before the Administrator password is set, but you cannot log onto the network as another user until the Administrator password is set.) To accomplish this, type a user name into **Name** and a desired password into **Password** and **Retype Password**. You may then set the options and privileges for this user using the other fields in this dialog as follows:

Access Control — Determines whether the user has access to all of the subsystems in this network or a subset of the subsystems. When a user is given access to a subsystem, he or she also gets access to all subsystems in the hierarchy below the specified subsystem. This option is available only for the top-level subsystem and the subsystems one level below the top-level subsystem in the hierarchy.

UI Setting — Determines whether this user will see the full set of Visio and LonMaker menus when viewing the drawing or just the ones included in the reduced user interface set. This option can be toggled while the drawing is open using the Minimum/Maximum UI command from the LonMaker menu. (See *Setting the LonMaker User Interface* for information on this command.)

Privileges — Specifies which types of objects the users can access, and what actions they can perform on those objects.

While **All Objects** is selected, changes you make to the **Actions** options affect all objects. For example, if you do not want to allow a user to modify any

objects, clear the **Modify** option while **All Objects** is selected.

While **Selection** is selected, the privileges options you select apply only to the object selected in the **Selection** list. For example, if you want this user to be able to modify functional blocks but not devices, select **Functional Blocks** and the **Modify** option, then select **Application Devices** and clear the **Modify** option.

4. Once you have set up the privileges and other options, click **Create** to create the new user profile.

   As the Administrator you can also delete any user profile other than the Administrator by selecting the user profile from the **Name** list and clicking **Delete**. A confirmation prompt is displayed. Click **Yes** to delete the selected user.

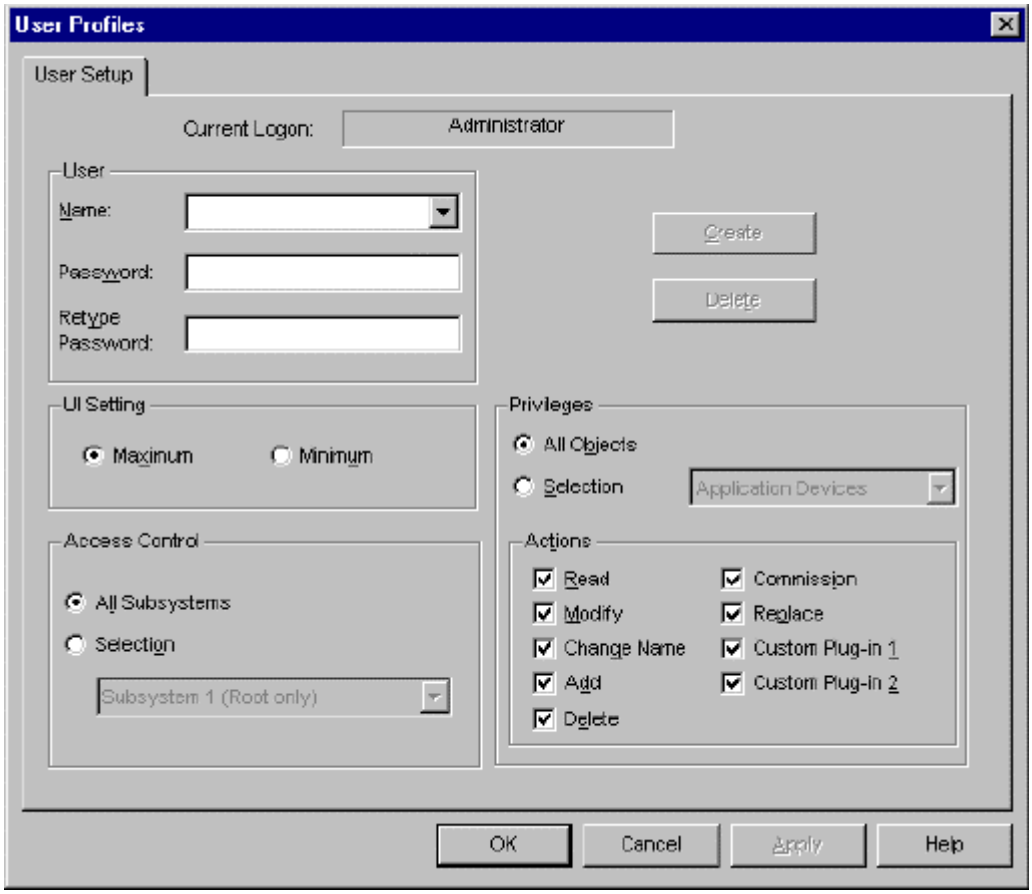
   After you have created user profiles, you can change any user permissions by selecting a user profile from the **Name** list, modifying the user profile's options, and clicking **Apply**. The LonMaker tool saves the changes for the selected user. If the user is currently logged on from another computer, they must close and re-open the LonMaker tool for the changes to take effect.

   To switch from the Administrator user account to a new user account, open the **LonMaker** menu and select **Network Properties**. Select the Logon tab in the Network Properties dialog and log in as another user.

Creating a New User Profile

If you are not the Administrator, you can still create other user profiles, although you may not grant them access or privileges that you do not have. Once you have created a new user profile, you cannot delete the new user profile or modify the new user's password, UI setting, access, or privileges. To modify these options, you must log in as the new user or as the Administrator. To create a new user from a non-Administrator user account, follow these steps:

1. Select **User Profiles** from the **LonMaker** menu. The following User Profiles dialog appears:



2. Enter the new user's name in the `Name` field, and the new password in **Password** and **Retype Password**. Both the user name and password are case sensitive. Set the options available to this user using the other fields in this dialog as follows:

Access Control	Determines whether the user has access to all of the subsystems in this network or a subset of the subsystems. You cannot grant a new user access to subsystems you cannot access. When a user is given access to a subsystem, he or she also gets access to all subsystems below the specified subsystem in the hierarchy. This option is available only for the top-level subsystem and the subsystems one level below the top-level subsystem in the hierarchy.
UI Setting	Determines whether this user will see the full set of Visio and LonMaker menus when viewing the drawing or just the ones included in the reduced user interface set. This option can be toggled while the drawing is open using the Minimum/Maximum UI command in the LonMaker menu. (See *Setting the LonMaker User Interface* for information on this command.)
Privileges	Specifies which types of objects the user can access, and what actions the user can perform on those objects. You may not grant a new user access to privileges you do not have. Select **All Objects** if you want to give the user the same privileges for all of the LonMaker objects. For example, if you do not want to allow a user to modify any objects, clear the **Modify** option while **All Objects** is selected. While the **Selection** button is selected, the privileges options you select

apply only to the object selected in the Selection list. For example, if you want this user to be able to modify functional blocks, but not devices, select **Functional Blocks** and the **Modify** option, then select **Application Devices** and clear the **Modify** option.

3. Click `Apply` to create the new user profile.

Changing Passwords

The Change Password tab allows you to change your password from a non-Administrator user account. To change your password, type your old password in **Old Password** and your new password in **New Password** and **Retype Password**, and then click **OK** or **Apply**.

Using the LonMaker Tool Remotely with User Profiles

When you open a LonMaker network on a remote client, you will be prompted for your user name and password if the Administrator password is set for the network. You are granted the same read and write permissions on the remote computer as you are on the server computer.

Note: The User Logon window in the LonMaker Startup Wizard (See *Opening an Existing LonMaker Network*) has a **Write Access** option that can be set or cleared by any user. This option does not override the privileges set in the user profile. A user who does not have modify privileges in the user profile cannot use this option to make changes to the LonMaker database.

For more information on write-access, see *Giving Users Write Access to LonMaker Drawings*.

Next Steps

Once you have planned your LonMaker network design, follow these steps to create it:

1. Start the LonMaker tool and *create a new LonMaker network* or *open a copy of an existing LonMaker network* If you have created a blank network (see the Note in *Creating and Opening a LonMaker Network Design* in Chapter 2, *Getting Started*), select it and open a copy of it.
2. Create the *channels*, *routers*, and *i*.LON 1000 servers.
3. Create the subsystem hierarchy.
4. If you plan on installing the network with multiple users, *create user profiles*.
5. Create the *devices*, *functional blocks*, *network variables*, and *connections*. If you are using the *ad-hoc scenario*, commission the devices and routers as they are defined.
6. Configure devices and functional blocks using plug-ins designed for that purpose or the LonMaker Browser.
7. If you are using the *engineered system scenario*, bring a computer running the LonMaker tool on-site or transfer the LonMaker network to an on-site computer, and commission all devices and routers.
8. Back up your LonMaker drawing and database as described in *Backing Up a LonMaker Network*. Archive your LonMaker backup file so that it is available to support future network maintenance.

4

Creating Networks

This chapter includes information on creating networks, such as creating a LonMaker drawing, subsystems, devices, i.LON Internet Server, supernodes, channels, functional blocks, and connections; working with LonMaker shapes and layers; customizing the LonMaker user interface; using LonMaker demo mode, and using LonMaker with AutoCAD drawings.

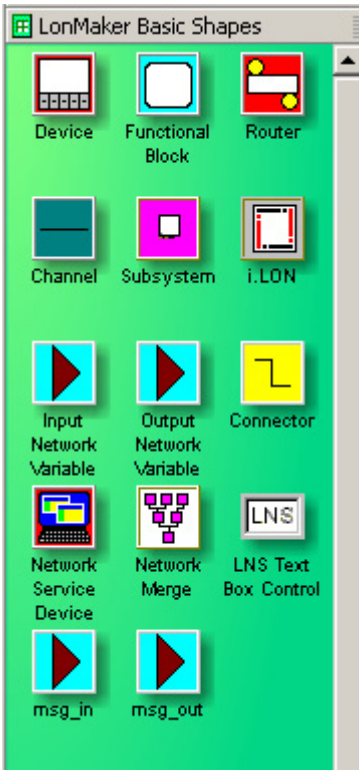
Creating a LonMaker Drawing

To create a network using the LonMaker tool, you add *Device*, *Functional Block*, *Connection*, *Router*, *i.LON*, *Channel*, and *Subsystem* shapes to your drawing. You add these LonMaker shapes by dragging shapes from a LonMaker stencil to your LonMaker drawing. The LonMaker tool starts the appropriate wizard that guides you through the process of creating each object. The following sections provide an overview of the LonMaker Basic Shapes stencil, and then describe how to use each of the shapes.

You can add LonMaker shapes to your LonMaker drawing at any time. You may be in a different physical location than the actual network, not attached to the network, and doing network design as described in the *Engineered System Scenario*. Or, you may be attached to the network as described in the *Ad-hoc Scenario* for the commissioning and maintenance of an engineered system.

Using The LonMaker and NodeBuilder Basic Shapes Stencils

The LonMaker tool includes LonMaker Basic Shapes Visio stencil. This stencil contains the basic shapes needed to create a LonMaker network as shown in the following figure:



If you have licensed the LonMaker tool as part of the NodeBuilder tool, the NodeBuilder Basic Shapes stencil will also be included. This stencil contains all the shapes contained in the LonMaker Basic Shapes stencil plus the Release Target Device and Development Target Device shapes that allow you to create NodeBuilder device shapes (see the *NodeBuilder User's Guide* for more information). The appropriate stencil opens automatically when you create a new LonMaker drawing.

To open a stencil manually from Visio, open the **File** menu, point to **Stencils**, and select **Open Stencil**.

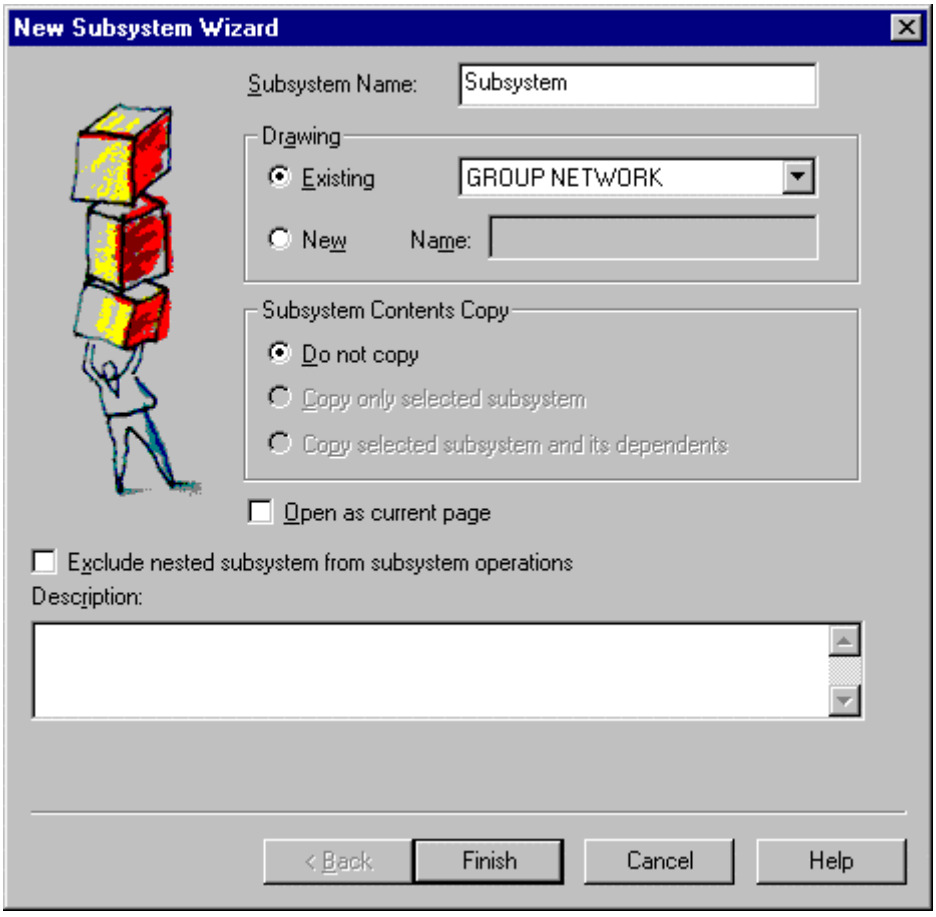
To add a LonMaker shape, drag it from the stencil to your LonMaker drawing.

Creating a Subsystem

Subsystems allow you to break a large network into more manageable parts. For example, in a building control network, one subsystem could contain lighting controls and another temperature controls. Each page of a LonMaker drawing represents a subsystem. Subsystems may be nested like directories on your computer, so the temperature control subsystem could contain other subsystems representing, for example, each floor of the building. You can also create subsystems in separate LonMaker drawings. Using this feature, you can create large networks while maximizing Visio's performance by limiting the number of pages in a single drawing. You can also create a separate LonMaker drawing for each user for large networks with multiple installers. For more information, see *Using Subsystems*.

To create a subsystem, follow these steps:

1. Drag the Subsystem shape from the LonMaker Basic Shapes stencil to your drawing. The New Subsystem Wizard opens.



2. Enter the following information:

Subsystem Name	The name of the new subsystem. Subsystem names may be up to 85 characters, may include embedded spaces, and may not include the period, backslash, colon, forward slash, or double quote characters. Subsystem names are case sensitive.
Drawing	Determines whether the new subsystem will be represented by a new page in an existing LonMaker drawing or by a page in a new LonMaker drawing. To create a subsystem as a page in an existing drawing, select **Existing** and choose one of the drawings associated with this LonMaker network. To create a subsystem in a new LonMaker drawing, select **New** and enter the name of the new drawing in **Name** (default is `<Network Name> <Subsystem Name>`).
Subsystem Contents Copy	When creating a new subsystem by dragging a Subsystem shape from the LonMaker Basic Shapes stencil, only the **Do Not Copy** option will be available. See *Copying a Subsystem or Supernode*.
Open as current page	If this checkbox is set, the LonMaker tool will open the subsystem you are creating once it is created. If not, you will stay in the subsystem where you dragged the subsystem shape.
Exclude nested subsystems from subsystem operations	If this checkbox is set, the LonMaker tool will only apply subsystem operations to the devices that reside within the subsystem. If this checkbox is cleared, the LonMaker tool will apply subsystem operations to devices within the subsystem and within all nested subsystems. The subsystem operations are: Commission, Load, Replace, Resync CPs, Manage, and Change Channel. The devices that can be affected by a subsystem operation will be listed within the Device tab of the Subsystems Properties dialog.
Description	Allows you to enter a description of this subsystem. This field has no effect on the operation of the network and is provided for as-built documentation.

3. Click **Finish** to create the new subsystem.
4. If you are creating this subsystem in a network that uses user profiles and passwords (see *User Profiles*), click **Next** to set *Guest Privileges* for this subsystem. Otherwise click **Finish** to create the subsystem.

Creating a Supernode

To create a supernode, *create a subsystem*, then create one or more devices and one or more functional blocks in the new subsystem as described in *Creating a Device* and *Creating a Functional Block*. To make the subsystem into a supernode, follow these steps:

1. Drag a network variable or message tag input or output shape onto the subsystem shape.
2. A dialog opens that allows you to select from all network variables or message tags of the appropriate direction contained in that subsystem or any of its nested subsystems. You can right-click and use the *network navigator* to expand, select, and clear items when choosing the appropriate network variables or message tags. Click `OK`.

Supernode network variable or message tag inputs and outputs created using the above procedure can be used to define connections, just as you would use network variable or message tag inputs

and outputs on a functional block. See *Creating a Connection* for more information on connecting network variables and message tags.

To change the name of or remove network variables or message tags on a subsystem object, select the subsystem shape and click the network variable or message tag shape to select it. Right-click the selected network variable or message tag shape to display the shortcut menu. To change the name, select **Properties** from the shortcut menu and enter the new name in **Exported Name** on the Properties dialog. To remove the network variable or message tag from the subsystem shape, select **Delete** from the shortcut menu. Changing the name of or removing a supernode network variable or message tag will not affect the name or existence of the network variable or message tag to which the supernode network variable or message tag corresponds. Network variable and message tag shapes that are bound cannot be deleted until they are unbound.

Note: Using more than 30 supernode network variable and message tags on a single supernode will have a negative effect on performance.

Accessing Subsystem Commands

The following subsystem commands are available from the Subsystem shortcut menu. To access the shortcut menu, right-click a subsystem shape or right-click the background of any LonMaker page.

Subsystem Properties	Attributes tab: lists the following properties for the selected subsystem: Name, Page, Parent, Handle, Exclude Nested Subsystems from Subsystem Operations, and Description. Devices tab: displays the selected subsystem and its contents, and lists the name, type, and state of each device in the selected subsystem. System Interface tab: lists the subsystem's network variables with their names, subsystem, device, and functional blocks. Guest Privileges: displays the Users Profile dialog box that allows the administrator to restrict access for defined users to particular subsystems, for example.
Delete	Removes the selected subsystem and all of its objects from the network.
Move	Relocates the selected subsystem to another subsystem in the network.
Go To Subsystem	Navigates from the current subsystem to the subsystem that you select. If you choose a device in the Select Object window, you will navigate to the subsystem to which the selected object belongs.
Plug-Ins	Lists the plug-ins available for the selected subsystem. See *LNS Plug-in Overview* for more information.
View Subsystem Layers	Allows you to select the option to display or hide the physical, logical, or data layers. See *Using LonMaker Layers* for more information.
Enable Monitoring	Turns monitoring on or off for all network variable connections. Applies to all subsystems.
Change Channel	Moves devices in the selected subsystem from the specified channel to the specified destination channel. See *Changing Channels* for more information.

Manage	Performs a series of operations on all devices and routers in the selected subsystem. See *Managing Networks Overview* for more information.
Commission	Associates the device shapes in the selected subsystem with the physical devices on the network. See *Commissioning Devices and Routers Overview* for more information.
Replace	Allows you to replace devices in the selected subsystem while leaving all functional blocks, connections, configuration properties, and network variables unchanged. See *Replacing Multiple Devices, Routers, or Subsystems* for more information.
Load	Allows you to select and download an application image to each device in the selected subsystem. See *Loading an Application Image* for more information.
Resynch CPs	Updates the configuration properties in all physical devices with the configuration properties for those devices in the LNS network database for the selected subsystem. See *Resynchronizing Configuration Properties* for more information.
Decommission	Uninstalls all devices in the selected subsystem. See *Decommissioning a Device* for more information.
Connect	Invokes the Network Variable Connection dialog to allow you to establish connections from and to any device in the network. See *Creating a Connection using the Connect Command* for more information.
Go To Parent Subsystem	Navigates to the subsystem one level up from the selected subsystem.

Updating Multiple Subsystem Devices

The LonMaker tool supports simultaneous updates of multiple devices in a subsystem when issuing the following subsystem commands:

- *Commissioning a Device or Devices* in Chapter 5, *Installing a Network*
- *Replacing a Device or Devices* in Chapter 6, *Maintaining Networks*
- *Loading a New Application into a Device or Devices* in Chapter 5, *Installing a Network*
- *Resynchronizing Configuration Properties* in Chapter 6, *Maintaining Networks*
- *Changing Channels* in Working with LonMaker Shapes in Chapter 4, *Creating Networks*

This capability is useful when you wish to perform the same operation on many devices. Since the process to update the network can be time consuming, this is the way to update the network when you need to issue any of these commands on multiple devices in a subsystem.

When issuing all of these commands on multiple devices in a subsystem, the LonMaker tool prompts you for input on each device, and then updates the devices after you input the required information.

The following table describes the required input and the rules applied when issuing the subsystem commands on multiple devices.

Commands	Input Required	Actions
Commission, Replace	Install Mode	Prompts one time for the device identification method. The option specified is applied to all selected devices in the subsystem.
Commission, Replace	Neuron ID	Prompts you to enter the Neuron IDs for all of the devices in the subsystem that do not already have a Neuron ID defined. In manual mode, enter the Neuron ID. In service pin mode, press the service pin in either of two modes: Automatic – The LonMaker tools chooses the first device in the list that does not already have a Neuron ID assigned and that qualifies based on the selected filters (channels and/or program IDs). Manual – Highlight the device in the list and press the device service pin. The device must match based on the selected filters. When replacing devices, enter the new Neuron IDs for those devices that you wish to replace. All devices that have a new Neuron ID specified, or new device template specified will be updated. Devices with a new template, but without a Neuron ID specified will only be updated in the database and the drawing.
Commission, Replace, Load	Application Image	Prompts one time for each unique device template to indicate whether to load the application image and the image's file name. The input for each device template will be applied to all devices in the subsystem with the same device template. This is useful for commissioning and replacing all devices in a subsystem or for firmware upgrading in all devices of the same type in a subsystem. For each device whose application is loaded, you are prompted to enter a Neuron ID if it is not defined. Devices that do not have a specified Neuron ID, but have a new device template specified will be updated to the new template in the database and drawing.
Replace, Load	Device Template	Prompts one time for each unique device template to specify the external interface definition.
Commission, Replace, Load	State	Prompts one time for the initial state. The option specified is applied to all selected devices in the subsystem.
Commission, Replace, Load	Source of Config Property Values	Prompts one time for the source of the Configuration Property values. The option specified is applied to all selected devices in the subsystem.
Change Channel	Channel Select	Prompts you to enter the original and destination channels. All devices attached to the original channel are moved to the destination Channel. You

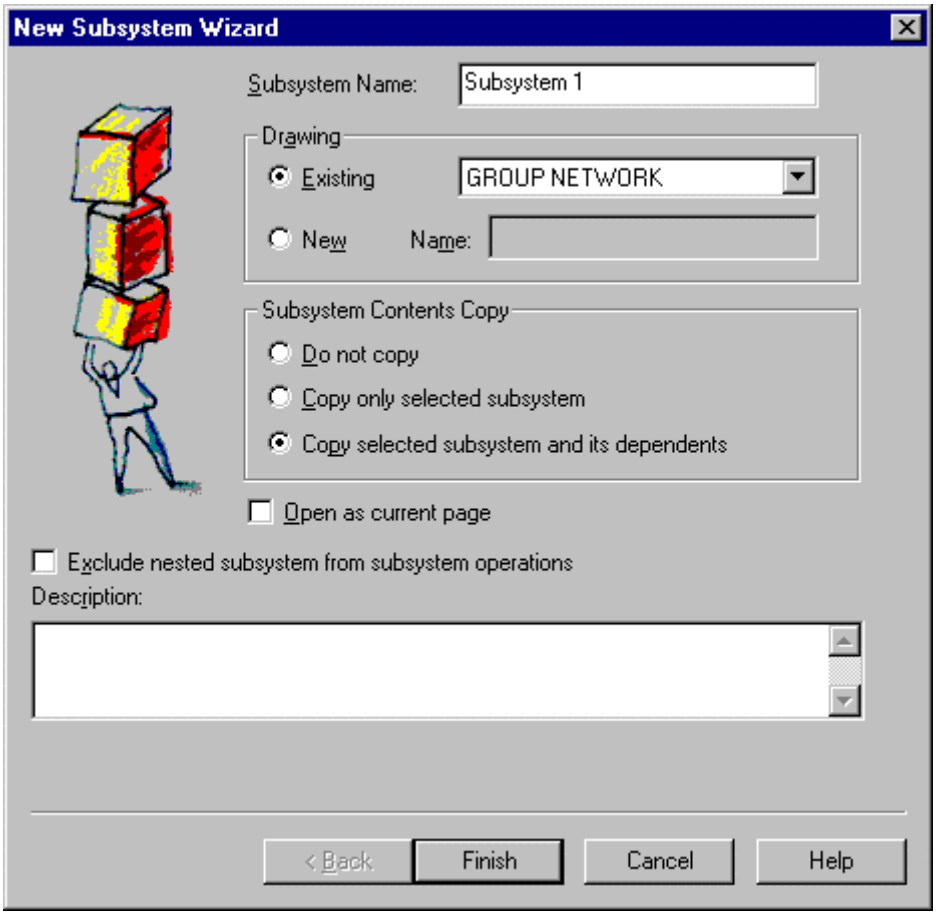
		can also enter the state of devices and routers after the channel move. The state (or states) that you choose is the state (or states) in which the LonMaker tool puts the devices and routers after the channel move.
Resync CPs	Option for Setting Configuration Properties	Prompts you one time to enter the option for setting the Configuration Property values. The option selected will be applied to all devices in the subsystem.

Copying a Subsystem or Supernode

You can copy a subsystem or supernode to create a new subsystem or supernode with the same devices, functional blocks, connections, and configuration as the original, including any nested subsystems and supernodes.

To copy a subsystem or supernode, follow these steps:

1. Right-click the subsystem or supernode shape to be copied and select **Copy** from the shortcut menu, then right-click anywhere in the LonMaker drawing, in the same or a different subsystem, and select **Paste**. Alternately, you can hold down Ctrl and drag the subsystem or supernode shape to the desired location of the copy. The following window appears.



3. Select one of the following Subsystem Contents Copy options:

Do not copy	None of the contents of the original subsystem will be copied. Only the subsystem shape will be copied.
Copy only selected subsystem and its dependents	All non-subsystem contents of the original subsystem will appear in the new subsystem. Nested subsystems and their contents will not be copied.
Copy selected	All contents of the original subsystem, including nested subsystems and their contents, will be copied into the new subsystem.

4. Select how subsystem operations will be applied to the subsystem. Set **Exclude Nested Subsystems from Subsystem Operations** to limit subsystem operations to the devices within the subsystem being copied. Clear the checkbox to have subsystem operations apply to all devices within the subsystem, including those within the nested subsystems. The subsystem operations are: Commission, Load, Replace, Resync CPs, Manage, and Change Channel. The devices that can be affected by a subsystem operation will be listed within the Device tab of the Subsystems Properties dialog.
5. Click **Finish**. The LonMaker tool copies the subsystem or supernode. If only a single end of a reference connection is in a copied subsystem, the network variable or message tag will be connected to the existing connection specified by the reference. The copy operation does not require any user input, with the following exceptions:

- The LonMaker tool prompts you to determine whether copied channel shapes represent an existing channel or a new channel.
- If the copy causes functional blocks to be created that are not associated with any device, the LonMaker tool prompts you to determine on what devices the new functional blocks reside.

Creating a Device

A device in a LonMaker drawing corresponds to a physical device on the network. Installing a device in a LONWORKS network is a two-step process. The first step, definition, typically does not require the LonMaker tool or the device to be attached to the network. In this step you choose the device shape and name, as well as the device template, location, channel, and description for the device.

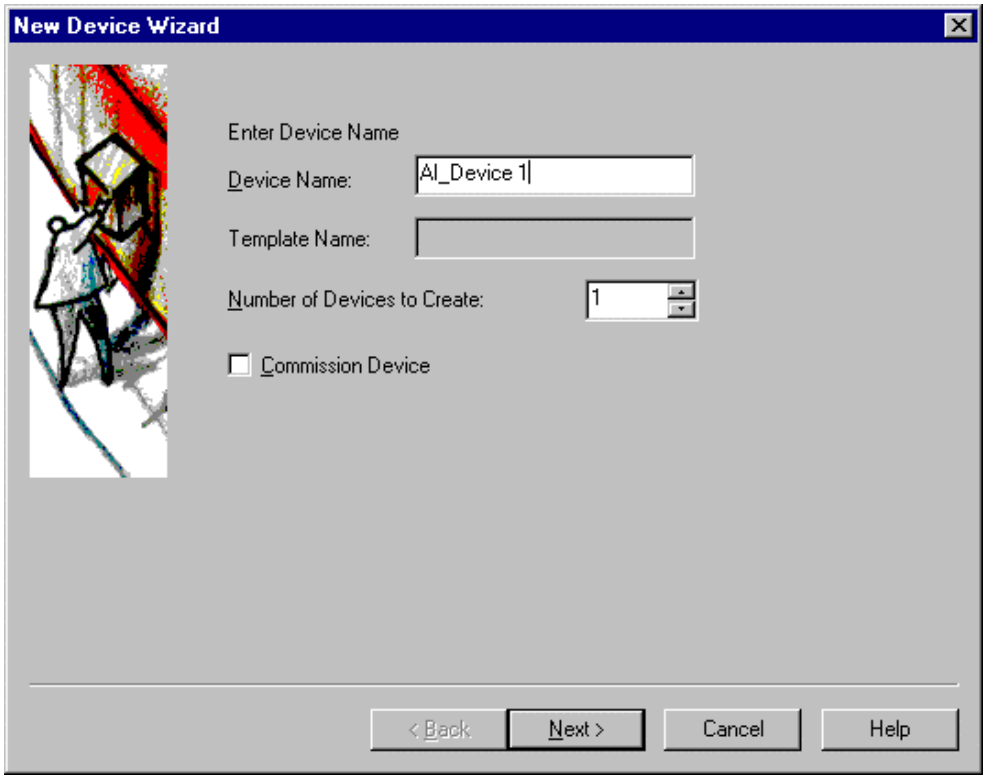
The second step, commissioning, associates the physical device with the device shape created in the LonMaker drawing. One way to complete this step is to commission devices that are attached to the network as described in *Commissioning Devices and Routers*. Another method is to partially commission a device, even if it is not connected to the network yet, by entering its Neuron ID into the database (manually or using a barcode scanner). Once the device and the LonMaker tool are attached to the network, you recommission it to complete the commissioning process. You can recommission all the devices in a network by right-clicking a blank area in your top-level subsystem and selecting **Commission** from the shortcut menu.

The separation of these steps means that you can design and configure an entire network including devices, connections, and functional blocks, off-site prior to commissioning the network using the LonMaker tool, and you can later bring the resulting database on site for commissioning, thus reducing the amount of time spent on site. This is referred to as the *engineered system* installation scenario.

The LonMaker tool also allows for the combination of these steps, defining and commissioning the device in one step. This allows the system installer more flexibility as additional devices can be installed as necessary. This is referred to as the *ad-hoc* installation scenario.

To create a device in a LonMaker drawing, follow these steps:

1. Drag the Device shape representing the device you wish to create from a LonMaker stencil to the LonMaker drawing page representing the subsystem in which the device is to be created. To create a NodeBuilder device, you can also drag a Release Target Device or Develop Target Device shape from the NodeBuilder basic stencil. Some devices, such as the LonPoint devices available from Echelon, have predefined LonMaker shapes associated with them that are supplied on a LonMaker stencil. You may create your own custom LonMaker device shapes as described in *Device Master Shapes*. If the device you are defining does not have a predefined LonMaker shape, use the generic Device shape from the LonMaker Basic Shapes stencil. When you release the mouse button, the New Device Wizard opens the following Device Name window.



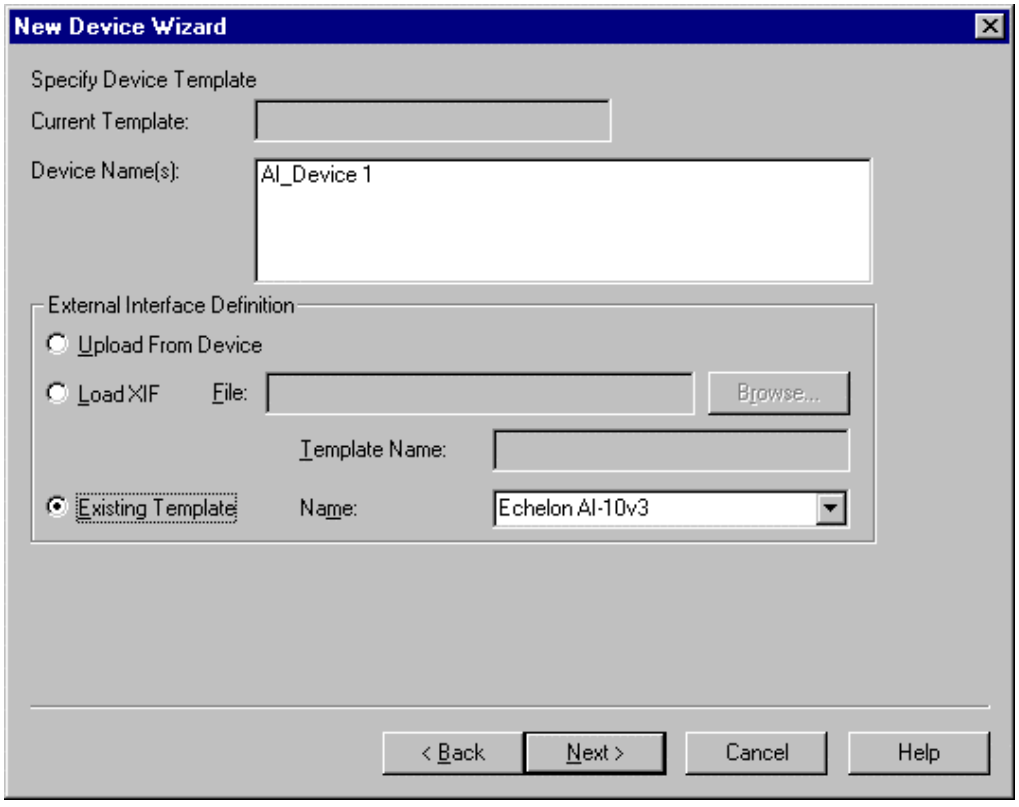
Enter for the following information for the device.

Device Name	The name of the device. This name must be unique within the current page (subsystem). The default name is the name of the device shape followed by an integer (e.g. `Device 1`). The device name may be up to 85 characters, may include embedded spaces, and may not include period, backslash, colon, forward slash, or double quote characters.
Template Name	The LNS device template that defines the device interface to the device. If the shape dragged from the stencil has a pre-defined device template (such as the LonPoint device shapes), that template will be indicated in this field. Otherwise, this field will be blank. This field is read-only.
Number of Devices to Create	The number of devices to be created. If larger than 1, the LonMaker tool will automatically increment the names of the additional devices and place them on the drawing adjacent to the first shape. If the device name does not contain a numeral

at the end, LonMaker will append the number 1 to the second device (for example, “Analog” for the first device becomes “Analog 1” for the second device), and increment the value for additional devices.

Commission Device — Setting this option allows you to perform the definition and commission steps of device creation together. If this option is selected, the windows used to commission a device will open after the definition windows and prompt you for commissioning information. This option is disabled if more than 1 device is being created.

2. Click **Next**. If you are creating a NodeBuilder device, a window appears allowing you to select the NodeBuilder device template. See the *NodeBuilder User’s Guide* for more information. Once you have clicked **Next** from that window, the following window appears.



3. This window allows you to select or define the device template for the device. If you have dragged a device shape that has a predefined device template, you will not see this window. See *Device Master Shapes* for more information on devices with predefined device templates. Otherwise, select from the following options:

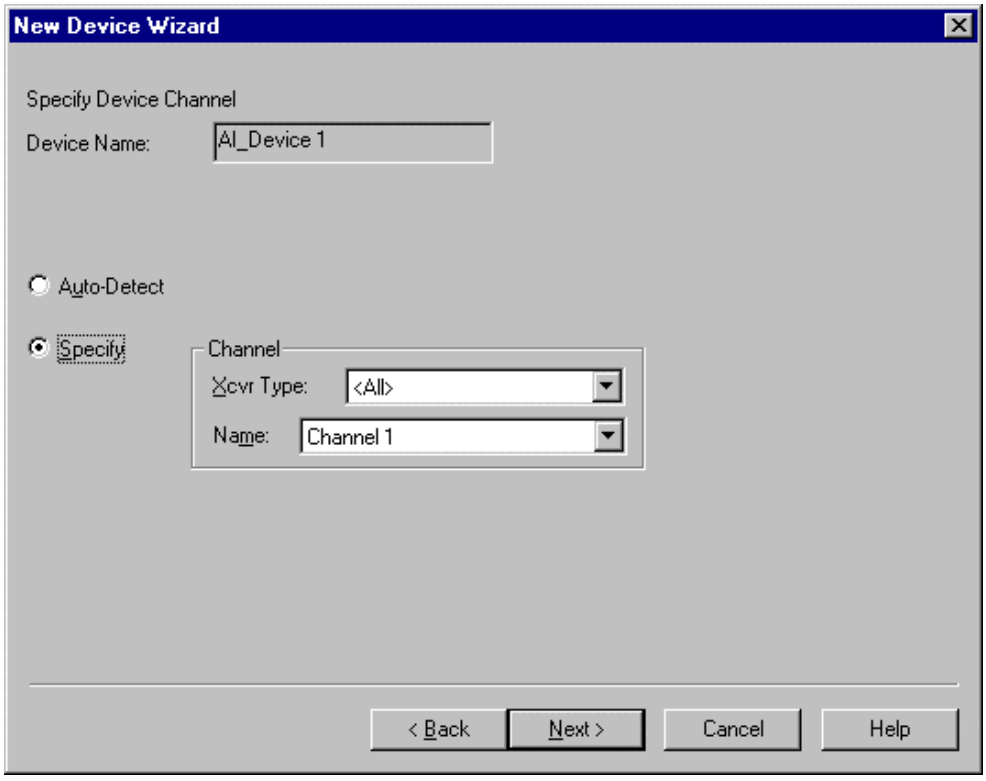
Upload From Device — Defines a new device template based on a device interface definition uploaded from the device. This option will be available if the LonMaker tool is attached to the network (even if it is currently OffNet). The device must be attached to the network if you select this option. If this method is used, enter a name for the new device template in the `Template Name` field. This template name must be unique to this network, may include

embedded spaces, and may be up to 85 characters long.

Load XIF — Defines a new device template based on a device interface file (.xif extension). You may either enter the path name or click **Browse** to locate the desired device interface file. If the file is in one of the directories specified in the Device options page of the `LonMaker` Options tab under **Network Properties**, you may enter the file name only. **Template Name** is set automatically to the name of the file (without the extension), but you can change it to any name for the new device template. The template name must be unique to this network.

Existing Template — If you have defined a device template previously using either the **Upload From Device** or **Load XIF** options, you may select from the template names defined when those methods were used. This is most useful when defining multiple devices of the same type and same device interface.

4. Click **Next** to open the following window:

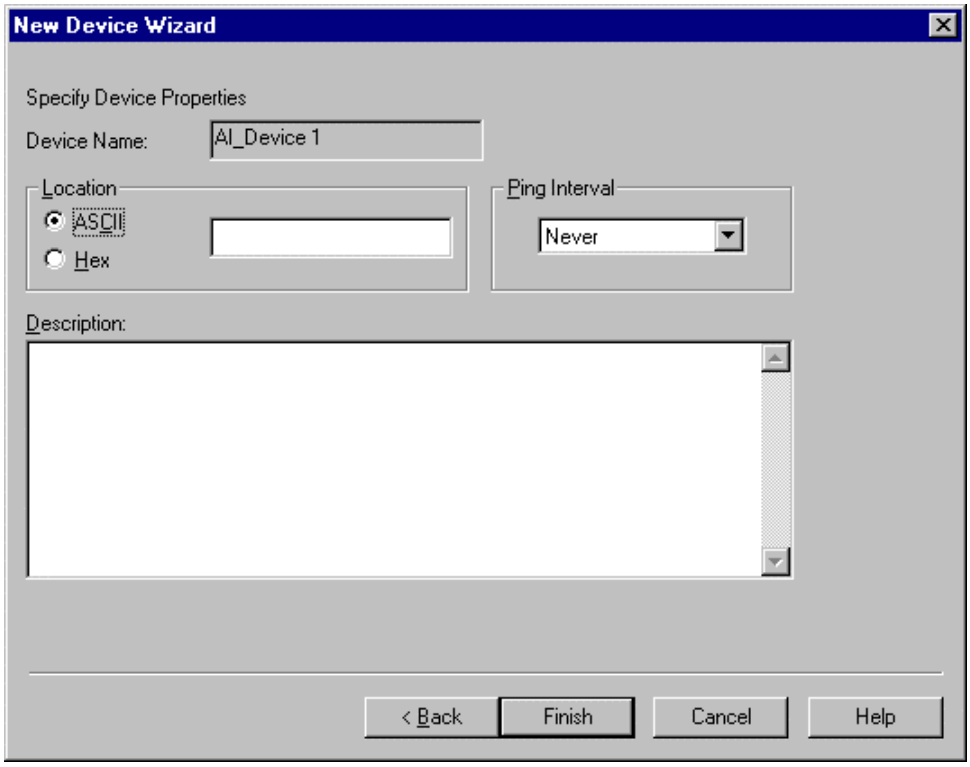


5. Use this window to specify the channel for the new device. If you select **Auto-Detect**, the LonMaker tool will automatically determine what channel the device is on. To use this option, you must ensure that the LonMaker tool is attached to the network and all routers between the LonMaker network interface and the device being defined have been installed and commissioned, and are online. Otherwise an error will be returned during commissioning.

   Do not use the **Auto-Detect** option if you are using routers configured as repeaters or bridges.

   If **Auto-Detect** is clear, you must explicitly select the channel to which the device is attached. Use **Xcvr Type** to list only the channels for a specific transceiver type (some device shapes

will limit the types of transceivers you can select). Click **Next**. The following window appears.



6. Enter the following information:

Location	Location information for this device. This information may be entered as an ASCII string (up to a 6 characters) or a hex string (up to 12 hex digits). It is used to document the device's location within the network. This information is not used by the LonMaker tool, but may be useful for network recovery if you lose the LonMaker drawing and database. For example, you can put an abbreviation of the subsystem name or a subsystem number in the `Location` field.
Ping Interval	Ping interval for this device. The ping interval determines how often a device is pinged by the LNS Server to ensure it is still operating and in communication with the network. Set the ping interval based on the expected attachment of the device to the network. If you expect that the device will never move on the network, select `Never`. Set the interval to `15 minutes` for a device you expect will move rarely, to `2 minutes` for a device you expect will move fairly often, and to `1 minute` for a device you expect will move very often. The default ping interval is `Never`. Any errors detected by pinging a device are displayed on the device shape in the LonMaker drawing. See *Using LonMaker Styles* for more information.
Description	A description of the device. This description has no effect on

network operation and may be used to provide additional documentation for as-built reports.

7. Click **Finish** to create the device shape and complete the device definition. If a shape representing the device's channel does not exist on the page in which the device is being created, the appropriate channel shape will be created automatically. If you selected the **Commission Device** option, the first commissioning window appears as described in *Commissioning Devices and Routers*.

Creating an i.LON 1000 Internet Server

An *i*.LON 1000 Internet Server is a single physical device that contains two LONWORKS devices: a router and a Web server. The router connects a LONWORKS channel to a LONWORKS/IP channel for transparently transporting LONWORKS data over IP. Up to 64 LONWORKS/IP devices, including *i*.LON 1000 servers may be attached to the same LONWORKS/IP channel. The LONWORKS channels attached to the *i*.LON 1000 Servers may be located in the same building, factory, or system, or they may be geographically separated. The Web server, defined as a device on the LONWORKS channel side of an *i*.LON 1000 Server, can contain network variables that connect to other devices in the LONWORKS network. It contains an embedded Web server that can serve Web pages that reference network variables to a web browser. To create an *i*.LON 1000 server, you need the *i*.LON 1000 software included with the *i*.LON 1000 Server.

The *i*.LON 1000 server is treated as a subsystem in the LNS database and is represented by an *i*.LON subsystem shape on the LonMaker drawing. This subsystem contains the *i*.LON router, Web server device, Web server functional block, and the LONWORKS/IP channel. As a subsystem, the *i*.LON server shape is not connected to any channel shapes. In addition, dialogs that display subsystems include any *i*.LON subsystems defined on the network. Shapes representing the *i*.LON devices (router and Web server) are displayed as part of an *i*.LON subsystem.

To create an *i*.LON 1000 server, follow these steps:

1. Drag the *i*.LON shape from the LonMaker Basic Shape stencil to the LonMaker drawing. The New Subsystem Wizard appears.
2. Enter the information for the subsystem: name and new or existing drawing. The **Contents Copy** option should not be changed from its default setting. See *Creating a Subsystem* for more information. Click **Finish** and the Channel Definition dialog appears.
3. The *i*.LON shape contains two channels: the LONWORKS/IP channel and the LONWORKS channel. The LonMaker tool displays the channel definition options for each channel in the subsystem. (See *Channel Definitions* for field descriptions.) Enter or modify the information for each channel. Some of the channel options may be read-only fields if the current dialog represents an existing channel. The transceiver type defaults to **IP 10-L** for the LONWORKS/IP channel. This default is correct if you are using IP across a LAN. If you are using IP across a WAN or the Internet, select **IP 10-W**. Click **OK** when finished.
4. To commission the *i*.LON 1000 server, ensure that the Configuration Server is running, then right-click the *i*.LON shape and select *Commission* from the shortcut menu. The Commission Device Wizard appears. Select the initial state and source of the configuration property values for the web server. Click **Next** and select the initial state of the router. Click **Next**.

   Press the service pin on the back panel of the *i*.LON 1000 server to commission the Web server and router. The LonMaker tool displays the *i*.LON server subsystem page, as shown in the following example.

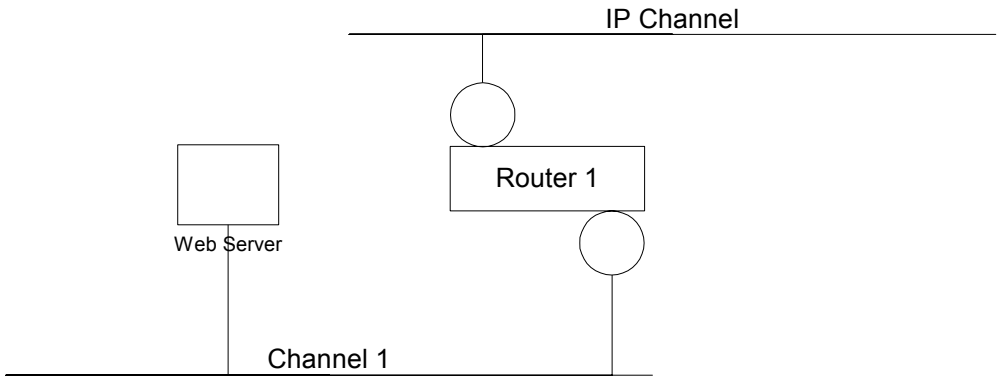


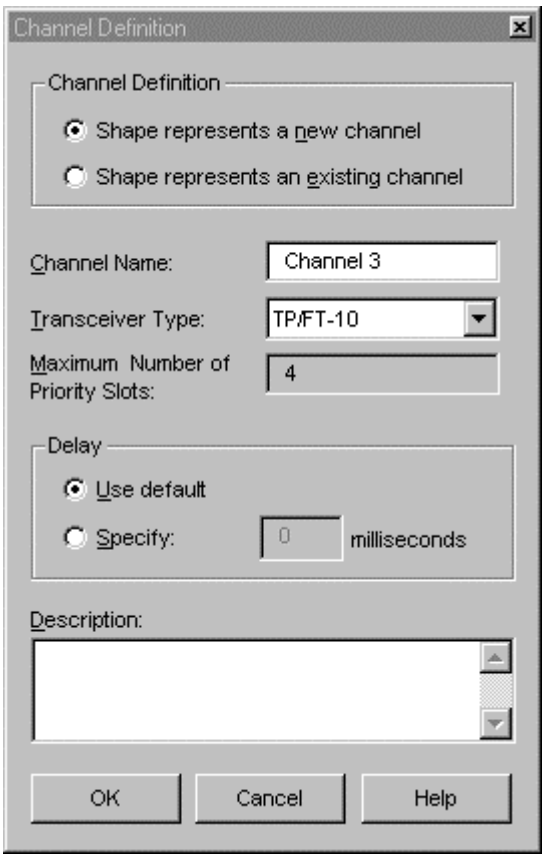
Figure 1 *i*.LON Subsystem Page Example

Creating a Channel

When you initially create a LonMaker network, it contains one channel named `Channel 1`. You may rename this channel, and you may create additional channels. Multiple channels allow you to use different media within the same network, isolate network traffic for performance, isolate devices for reliability, and increase the number of devices beyond the limit imposed by a particular transceiver technology.

To create a channel, follow these steps:

1. Drag the Channel shape from the LonMaker Basic Shapes stencil to the drawing. The Channel Definition dialog appears:



2. Enter the following information:

Channel Definition	Set **Shape Represents an Existing Channel** if the channel shape represents a channel that already exists in another subsystem. This option allows you to put devices in different subsystems on the same channel. Each page may have only one channel shape for each LONWORKS channel, but the same channel may appear on many pages.
Channel Name	Lists existing channel names if you indicated above that the new channel shape represents an existing channel. If this shape represents a new channel, specify a name that does not duplicate an existing channel name. This name may contain up to 85 characters.
Transceiver Type	Lists channel types if a new channel is being created. Select the one that corresponds to the transceiver used on the channel this shape will represent. If a shape representing an existing channel is being created, this field will set the channel type to the channel indicated in **Channel Name** and will be read-only.
Maximum Number of Priority Slots	Displays the maximum number of priority slots available on this channel. This field is read-only unless **Transceiver Type** is set to **Custom**.
Delay	Select whether to use the default delay time or to specify a delay time for the channel in milliseconds. If you are explicitly setting the delay, set the value to the expected longest round-trip time of

	a message (for example, message and response). This choice allows expected traffic patterns to be input to the system so that the timer calculations can be affected accordingly. Select **Use Default** to use the default of two packet cycles based on the average packet size.
Description	Enter a description of the channel in this field if a new channel is being created. This field has no effect on network operation and may be used to provide additional documentation for as-built reports. If this shape represents an existing channel, you cannot modify this field.

3. Click **Finish** to create the new channel shape in the LonMaker drawing.

Using LonMaker Layers

LonMaker layers are views in Visio that display related components of your LonMaker network. For example, the physical layer organizes related shapes—such as devices, routers, channels, and subsystems—on a LonMaker page. Each layer makes a different group of LonMaker shapes visible on the drawing. The LonMaker tool defines three layers initially, but you can define additional layers as described in *About Layers* in the Visio help file. Use the LonMaker toolbar to view and hide the predefined LonMaker layers on your drawing. The LonMaker tool defines the following layers.

Physical Layer	Shows all devices, routers, channels, and subsystems on a page. Click the toolbar button to view or hide the physical layer on your drawing.
Logical Layer	Contains all functional blocks, message tags, network variables, unmonitored connections (or all connections if selected in Network Properties), and subsystems on a page. Click the toolbar button to show or hide this layer.
Data Layer	Contains all monitored connections on a page. This may be changed in the Network Properties. Click the toolbar button to show or hide this layer.

Using Functional Blocks Overview

A functional block represents a collection of network variables and configuration properties on a device that perform a related function. For example, a digital input device with four hardware switches could contain one functional block for each switch. Functional blocks were formerly known as *LONMARK objects*.

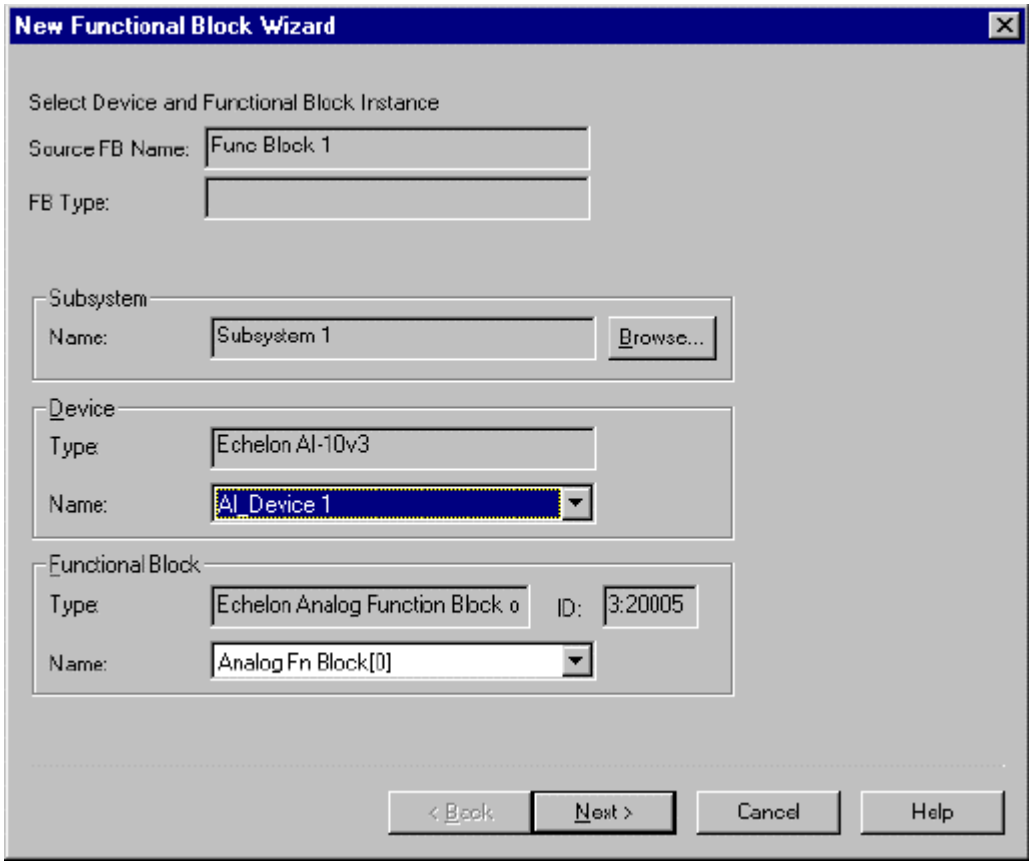
A device may include network variables, configuration properties, and message tags that are not part of any functional block. A special type of functional block, known as a *virtual functional block* contains these interfaces. The virtual functional block is not actually a functional block, it is only a convenient way provided by the LonMaker tool to access the parts of the device interface that are not contained within standard functional blocks.

The device template defines the functional blocks on a device and the network variables and configuration properties supported by each, as well as the network variables and configuration properties not contained by any functional blocks.

Creating a Functional Block

To create a functional block, follow these steps:

1. Drag a LonMaker shape representing the functional block from a LonMaker stencil to the drawing. Some devices, such as the LonPoint devices, have predefined LonMaker functional block master shapes associated with them, which have the appropriate input and output network variable shapes already attached. You may create your own custom LonMaker Functional Block shapes as described in *Functional Block Master Shapes*. If the functional block you are creating does not have a predefined LonMaker shape, use the generic Functional Block shape from the LonMaker Basic Shapes stencil. The New Functional Block Wizard appears.



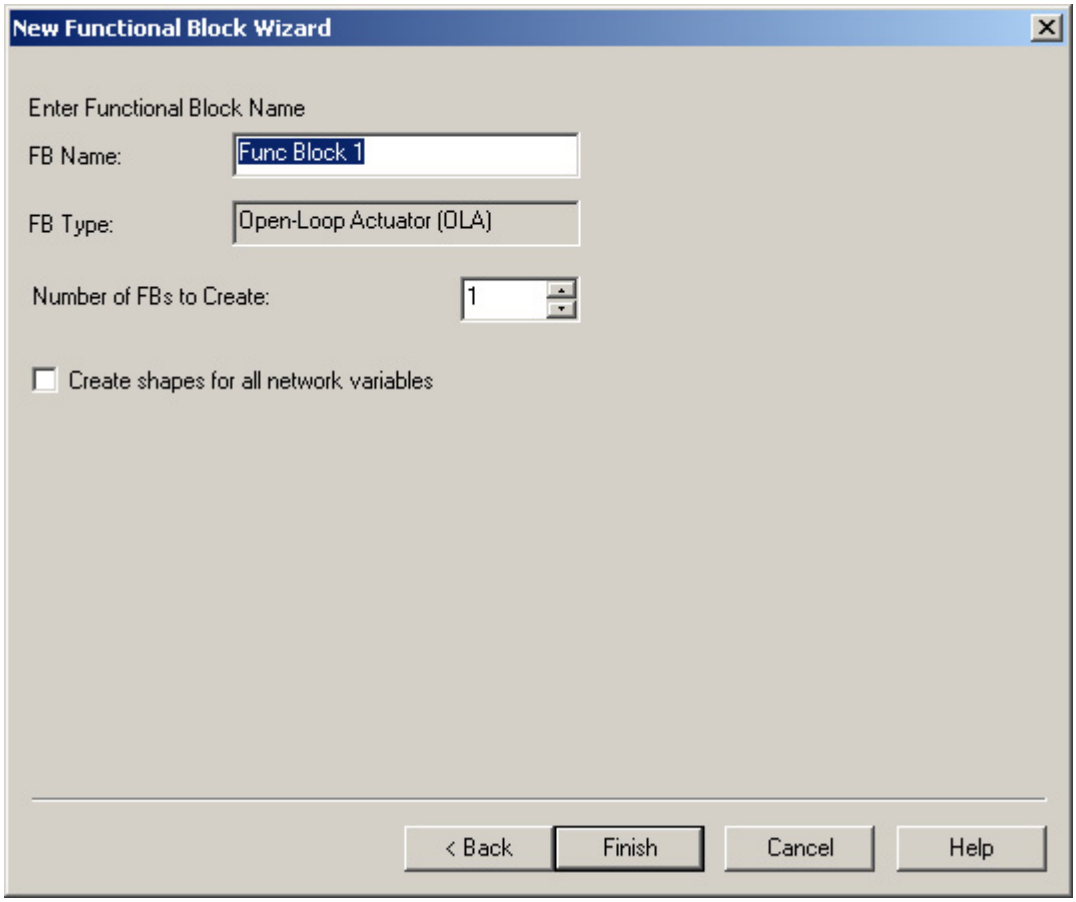
2. Enter the following information:

Subsystem Name	The subsystem in which the functional block's device is defined. The default is the subsystem where you dropped the functional block. You may select a different subsystem by clicking **Browse**.
Device Name	Contains all devices in the selected subsystem that have an available functional block that matches the type of functional block that you are creating. If you are creating a generic functional block shape, all devices in the selected subsystem with available functional blocks will be listed. Select a device from

this list.

Functional Block Name — Contains all available functional blocks on the selected device that match the type of the functional block that you are creating. If you are creating a generic functional block shape, all available functional blocks on the selected device will be listed. Select a functional block.

3. Click **Next** to open the following window.



4. Enter the name of the functional block being created in **FB Name**. This name must be unique within the device and should be descriptive of the function to be performed by the functional block. The name may be up to 85 characters, and may not include the period, backslash, colon, forward slash, or double quote characters.

   The default names created by the LonMaker tool for functional blocks are numbered beginning with 1, for example DE- 1.

   The LonMaker tool optionally includes the name of the functional block device with the functional block shape in the drawing in the format *<device name>.<functional block name>*. To enable this feature, open the **LonMaker** menu and choose **Network Properties**. From the dialog, select the LonMaker Options tab and the **Functional Block** category. Set **Include Device Name in Default FB**.

5. Enter the number of functional blocks to be created. When more than one functional block is created, the additional functional blocks will retain the same name as the first, and will be

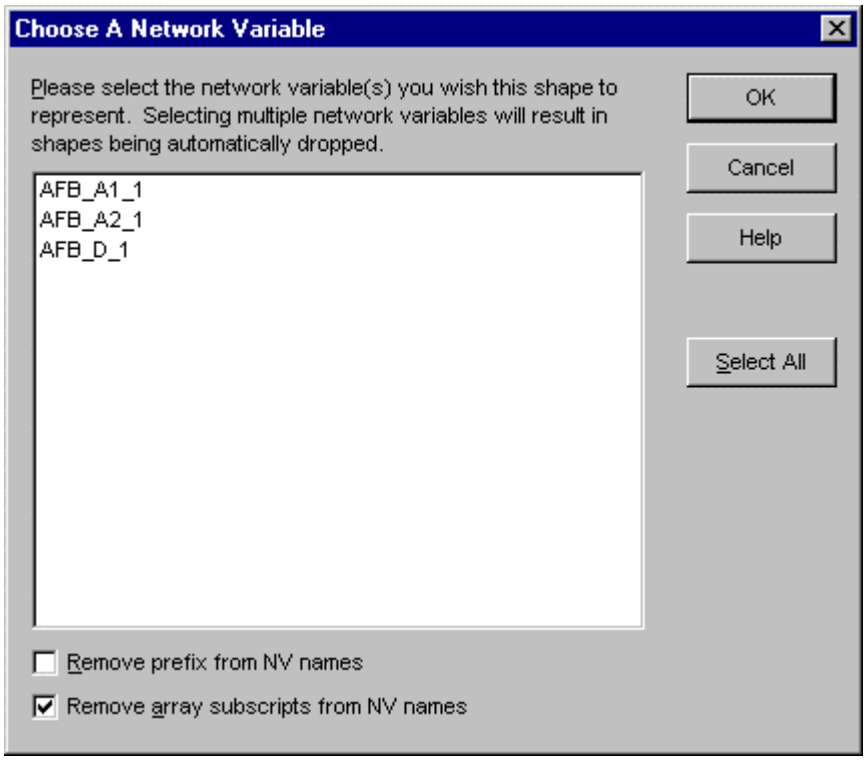
assigned to other devices in the same subsystem. For example, if the first functional block is assigned to Device 1, the second will be assigned to Device 2. If a matching device does not exist, you are prompted to select the device.

6. Set **Create Shapes for all Network Variables** to create shapes for all input and output network variables on the functional block. If this is not done, you can add network variable shapes to the functional block as described in *Adding Network Variables and Message Tag Shapes*.
7. Click **Finish** to add the functional block shape to the LonMaker drawing.

Adding Network Variable and Message Tag Shapes

If you create a functional block using the Functional Block shape from the LonMaker basic stencil and clear **Create Shapes for all Network Variables**, it will have no network variable or message tag shapes on it. The functional block still has all of its network variables and message tags, but they are not graphically represented. Network variable and message tag shapes are not required to create connections. However, adding network variable and message tag shapes on the drawing provides documentation and provides an easy way to make connections with the Connector shape as described in *Creating a Connection Using the Connector Shape*. Alternately, if you use the Connector shape to add connections between functional blocks *without* network variable or message tag shapes, the LonMaker tool displays the Connection dialog for you to select the network variables and message tags.

To place network variable or message tag input or output shapes on a functional block shape, drag an Input or Output Network Variable or Message Tag shape from the LonMaker Basic Shapes stencil to the functional block. The Choose Network Variable or Choose Message Tag dialog appears.


Choose A Network Variable
Please select the network variable(s) you wish this shape to represent. Selecting multiple network variables will result in shapes being automatically dropped.
AFB_A1_1
AFB_A2_1
AFB_D_1
OK
Cancel
Help
Select All
Remove prefix from NV names
Remove array subscripts from NV names

All the network variables or message tags of the specified direction for the functional block are listed in the dialog. Choose one or more of the network variables available for the specified

functional block and click **OK**. The Network Variable or Message Tag shape (or shapes) appears on the functional block shape. The input network variables and message tags are automatically positioned on the left and output network variables and message tags are automatically positioned on the right of the functional block shape. The LonMaker tool will not allow you to create more network variable shapes than defined in the device template unless the device supports dynamic network variable creation (for example, network service devices and host-based devices with dynamic network variable support). See *Binding Network Variables to the Host* in Chapter 10, *Monitoring and Controlling Devices* for more information on creating dynamic network variables.

If you set **Remove Prefix from NV Names**, the `nvi` or `nvo` string will be removed from the beginning of the network variable's name. If you set **Remove Array Subscripts from NV Names**, any endings of network variable names that are of the form _<n> or `[<n>]`, where `<n>` is a decimal number will be removed.

Once you have placed a network variable on a functional block, you can change the network variable name and the LonMaker tool will record the change in the drawing and the LNS network database. To change the name of a network variable, select its functional block and click the network variable shape to select it. Right-click the network variable shape, click **Properties** on the shortcut menu, and then enter the new name in **Name**. You cannot change message tag names.

The LonMaker tool only requires that network variable names be unique within a functional block; thus, if you list all network variables in a device, some may have duplicate names.

Once a functional block has a network variable or message tag input or output placed on it, the network variable or message tag shape becomes part of the functional block shape. If you move the block within the drawing or from one subsystem to another, the network variable and message tag shapes will remain in their position on the functional block shape.

To change the position of a network variable or message tag shape on a functional block, select its functional block and click the network variable or message tag shape to select it. Use the mouse to drag the selected network variable or message tag shape to its new position.

Note: You can move a network variable or message tag shape only if the **Automatic Positioning** option on the network variable or message tag is *not* selected. Right-click a network variable or message tag shape and then click **Automatic Positioning** on the shortcut menu to change this option.

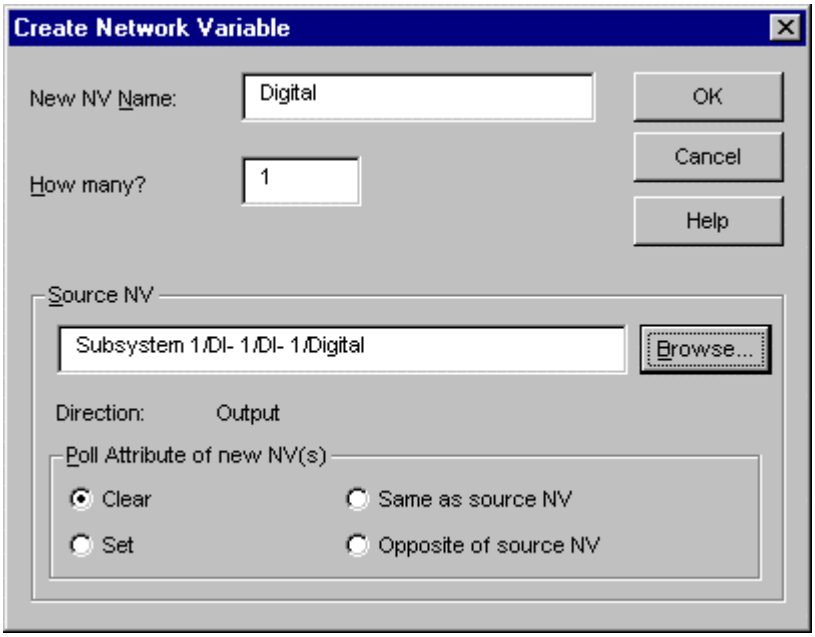
Once a functional block has all desired network variables and message tags placed on it, you can create a master shape with the functional block and its connection points. This is accomplished by dragging the functional block shape with the network variables and message tags to a LonMaker stencil to which you have write access. Manufacturers may also supply custom master shapes for their functional blocks, such as the LonPoint functional block master shapes that are available for the LonPoint devices. See Chapter 11 for more information on creating and using LonMaker custom stencils.

Dynamically Creating Network Variables

Some devices support the dynamic creation of network variables on their functional blocks. This means that you can create new network variables on the device after it is added to the network. Examples of devices that support dynamic network variable creation are network service devices (see *Binding Network Variables to the Host*), i.LON 1000 Internet Server, i.LON 100 Internet Server, and several MIP devices. To create a network variable on a functional block that supports dynamic functional block creation, follow these steps:

1. Assure that the functional block on which you want to create the network variables has been created in the LonMaker network drawing. If you are creating network variables on a network service device, you should create a functional block shape for the network service device's virtual functional block.

2. Drag a network variable shape of the desired direction from the LonMaker Basic Shapes stencil to the functional block. If the functional block supports dynamic NV creation, the Choose a Network Variable dialog appears, as described in *Adding Network Variables and Message Tag Shapes*, except the dialog will also have a button labeled **Create NV**. If the functional block does not support dynamic network variable creation, this checkbox will not be displayed.
3. Click **Create NV**. The Creating a Network Variable dialog appears.



4. Click **Browse** and choose the source network variable. Typically this is the network variable to which you will be binding the new network variable, but you can use any network variable with the appropriate type and direction. The new network variable will have the same type and opposite direction as the source network variable. The source network variable is used as a template for creating the new network variable (with the exception that the direction of the new network variable will be the opposite of the source network variable). The new network variable is not automatically bound to the source network variable.
5. Set **Poll Attribute of New NV(s)** to determine whether the new network variable will have polled monitoring enabled by default. The **Clear** and **Set** options will disable and enable polling on the new network variable, respectively. The **Same as Source NV** and **Opposite of Source NV** options will use the source network variable to determine whether polling will be enabled on the new network variable.
6. Click **OK**. You are returned to the Choose a Network Variable dialog. The new network variable will be selected. Click **OK** to add the network variable shape to the functional block.
7. Click **OK** to add the network variable shape to the functional block.

When you create a dynamic network variable using the above procedure, the LonMaker tool assigns a name to the dynamic network variable based on the following rules. The rules are different for a network variable that is a member of a functional block (a *functional block network variable* or *FBNV*) and for a network variable that is not a member of functional blocks (*device network variable*).

The following rules apply to dynamic functional block network variables (FBNVs):

- If the name that you specify for a dynamic FBNV does not contain a "_<xxx>" suffix where "<xxx>" is equal to the functional block index, the LonMaker software will append such a suffix to the name. As a result of this rule, you cannot assign a dynamic

FBNV name containing a suffix of "_<xxx>" where <xxx> is a three digit decimal number, unless the number is the same as the functional block index.

- Dynamic FBNV names are limited to 12 characters, including any member suffix that must be added to make the member name unique within the functional block. This is different than the "_<xxx>" functional block suffix, which does not count to the 12 character limit.
- When you create a dynamic FBNV by dropping a master shape or copying an existing functional block shape, the LonMaker tool will automatically truncate the FBNV name, if required, to meet the 12-character limitation.
- If you drag a master shape containing any functional blocks with dynamic network variables to a drawing, and the creation of any of the dynamic FBNVs fails, the functional block containing the failed dynamic FBNV will not be added, and all subsequent shapes in the master shape will not be processed, including any connections.
- When you rename a dynamic FBNV, if the update to the FBNV's programmatic name fails for any reason, the name change will not be allowed.

As a result of these rules, the format of the programmatic name of a dynamic FBNV is as follows:

<*baseName*><*memberIndex*>_<*FBindex*>

The *baseName* is 1 or more characters specified as the name of the FBNV. The *memberIndex* is 0 or more decimal digits required to make the name unique within the functional block. The *FBindex* is a 3-digit decimal number that equals the functional block index.

The following rules apply to dynamic device NVs:

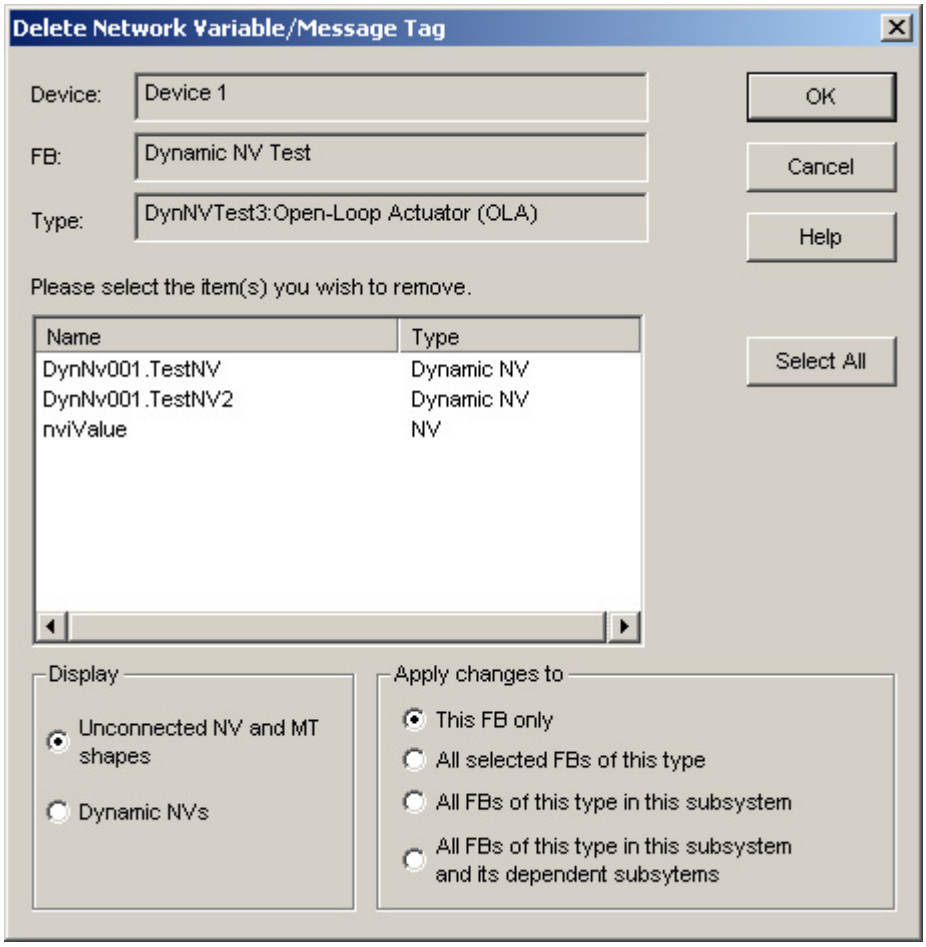
- When you create a dynamic device NV, you must specify a name that is valid for the programmatic name for the NV on the device. That is, the name is limited to no more than 16 characters, may use only alphanumeric characters, and the first character must be a letter. In addition, the name must be unique if required by the device. If the name is not valid, the dynamic device NV will not be created.
- Dynamic device NVs cannot have a suffix of "_<xxx>", where <xxx> is a 3-digit decimal number.
- When you rename a dynamic device NV, the LonMaker tool will attempt to update the name of the NV on the device. If the update fails for any reason, the LonMaker tool will report the failure, leaving the name of the NV on the device unchanged, but will update the name locally.

Removing Network Variable and Message Tag Shapes

The LonMaker tool provides the following two methods for removing network variables and message tag shapes from a functional block:

- If you want to remove an individual network variable or message tag shape (including its network variables from a single functional block), right-click the shape, and then click **Delete** on the shortcut menu.
- If you want to remove network variables and message tag shapes from multiple functional blocks, complete the following steps:

1. Right-click the functional block
2. Click **Delete NVs and MTs** on the shortcut menu to open the following dialog:



This dialog allows you to remove unconnected Network Variable and Message Tag shapes from a Functional Block shape. In the case of dynamic network variables, the network variable itself can optionally be removed from the devices.

3. Select the shapes you wish to remove by holding down `Shift` and clicking each one.
4. Set the following options:

Display — Determines which Network Variable and Message Tag shapes will be displayed. Select **Unconnected NV and MT Shapes** to view all unconnected Network Variable and Message Tag shapes on this functional block. Select **Dynamic NVs** to list only the unconnected dynamically created network variables. Dynamic network variables will only be removed from the device if `Dynamic NVs` is selected (otherwise only the network variable shapes will be removed). See *Dynamically Creating Network Variables* for more information on dynamic network variables.

Apply changes to — Determines which functional blocks will have network variables and message tags removed. Only unconnected network variables and message tags may be removed, regardless of this option.

Configuring a Functional Block

You can configure a functional block by right-clicking the functional block shape and then clicking **Configure** on the shortcut menu. If the functional block has a registered configuration

plug-in (such as the LonPoint plug-in for LonPoint functional blocks) that plug-in appears. If the functional block does not have a configuration plug-in, the *LonMaker Browser* appears.

If you are configuring a LonPoint functional block, see the *LonPoint Application and Plug-in Guide* and the LonPoint Plug-In help file for information on using the LonPoint Plug-In.

See also *Copying the Configuration of a Functional Block*.

Copying a Functional Block Configuration

Once you have configured a functional block, you can create new functional blocks with an identical configuration using one of the following four methods:

- Hold down the Ctrl key and drag the functional block to a new location within the same network.
- Create a custom LonMaker shape as described in *Creating a Custom LonMaker Shape.* The new custom LonMaker shape includes all the settings for any configuration properties that you modified, and can be reused in the same LonMaker network design, or in any other LonMaker network design. Drag the new shape to your LonMaker drawing.
- Right-click a functional block shape, and then click **Replicate** on the shortcut menu. Windows appear that allow you to copy a selected set of configuration properties to multiple target functional blocks.
- Use the **Copy Config** and **Paste Config** commands from the shortcut menu.

  To use the **Copy Config** and **Paste Config** command, follow these steps:

  1. Right-click the functional block shape to be copied.
  2. Select **Copy Config** from the shortcut menu.
  3. Right-click the functional block shape to be updated with the copied configuration.
  4. Select **Paste Config** from the shortcut menu.

  You can also paste the configuration properties to a text file to get a summary of the configuration property settings. To copy configuration properties to a text file, follow these steps:

  1. Right-click the functional block shape to be copied.
  2. Select **Copy Config** from the shortcut menu.
  3. Open a text editor or word processing application such as Windows WordPad or Word.
  4. Select the **Paste** command from the text editor or word processing application.

Functional blocks created using any of the above methods will have the same configuration property settings and network variable types as the original functional block. Once you have created a functional block, any changes that you make to its configuration properties are saved in the LNS database, but are not saved to other functional blocks of the same type.

Creating a Connection Overview

You can connect compatible network variables and message tags on the functional blocks in your LonMaker drawing. A connection causes an output update for a network variable or message tag to be propagated via the network to all connected inputs. You may connect input network variables to output network variables of the same type, input message tags to output message tags, and output message tags to output message tags. For details on changing network variable types, see *Changing Network Variable Types*.

Any functional block or supernode shapes in a system with compatible network variables or message tags may be connected, regardless of whether they are on the same page. There are two methods used to connect network variables and message tags. The first uses the Connector shape on a LonMaker stencil; the second uses the Connect command.

Every connection has one *hub* network variable or message tag and one or more *target* network variables or message tags. When creating a connection with one input and one output, it does not matter which end of the connection is the hub and which is the target. However, when creating large *fan-in* (multiple outputs connecting to a single input) or *fan-out* (a single output connecting to multiple inputs) connections, making the common network variable the hub will reduce the time required to make the connection. For example, in a fan-in connection, the single input should be the hub; in a fan-out connection, the single output should be the hub.

After a connection has been created, additional functions are available by right-clicking a connection or a network variable. They include the following:

- From a network variable, **Properties** displays the properties of the network variable
- From a connection:
    - **Remove/Undo Remove** removes and restores the connection
    - **Details** displays connection attributes
    - **Assign** copies the currently selected connection description to the connection selected in the Connection window
    - **Replicate** allows you to duplicate connection changes to other subsystems

Creating a Connection with the Connector Shape

The simplest way to create a connection is to use the Connector shape from the LonMaker Basic Shape stencil. You can only use this method to connect functional blocks or supernodes in the same subsystem.

To connect supernodes and functional blocks with network variable and message tag shapes, drag a Connector shape to the drawing and drop it so one end of the Connector shape locks onto one of the network variables or message tags you want to connect (the point where they connect will be highlighted red). Then drag the unconnected end of the Connector shape to the other network variable or message tag you want to connect. To connect multiple inputs to a single output (fan-out connection) or multiple outputs to a single input (fan-in connection), repeat the process with additional Connector shapes.

Connector shapes that have been properly connected on both ends will be black. Otherwise, the connector shape will be red.

Each Connector shape has a hub end and a target end. The hub end is denoted by an **x** and the target end is denoted by a **+**.

When connecting multiple message tags as a group, connect output message tags together (instead of using the msg_in tag). Select one of the output message tags as the hub and connect it to all the other output message tags (do not daisy chain the connection). The resulting connection will be the same regardless of which message tag you select as the hub.

To attach a Connector shape to a functional block that does not have network variable or message tag shapes in it, attach the Connector shape directly to one of the four x's on the functional block. Once two functional blocks have been connected in this manner, the *Connection Properties* dialog opens.

Caution *You cannot connect LonMaker shapes using the Visio connector tool or line drawing commands. If you use these methods, the database will not be updated and the connection will not be created.*

See *Connection Master Shapes* for information on creating multiple connections in a single operation.

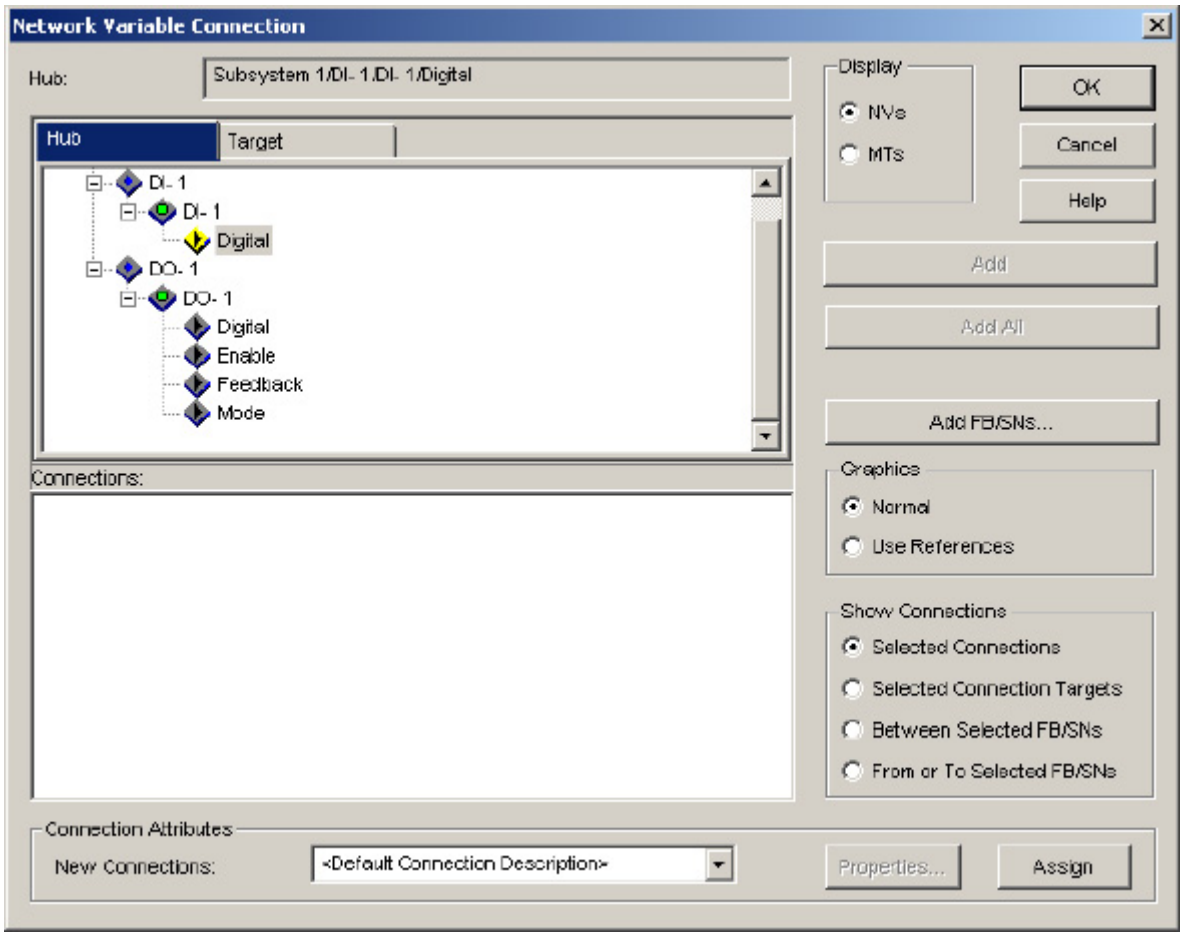
Creating a Connection with the Connect Command

The *Connect* command provides a very powerful and flexible method of creating connections. You can use the Connect command for any type of connection. You *must* use the Connect command in the following situations:

- The network variables or message tags to be connected are in different LonMaker subsystems
- You wish to connect the network variables or message tags by reference (a connection created using the Connector Shape method can be changed to a reference connection after it is created).
- You wish to modify the connection properties as the connection is being made (a connection created using the Connector Shape method can have its properties modified after it is created or a connection master shape can be created with the desired properties).

To make a connection using the Connect command, follow these steps:

1. Select one or more of the functional blocks or supernodes that you want to be connected by `Shift`-clicking each one, then right-click one of the selected shapes, and then click **Connect** on the shortcut menu. You can select functional blocks and supernodes from any number of subsystems or Visio pages. Alternatively, you can also right-click an empty area in any subsystem, then then click **Connect** on the shortcut menu. The Connection dialog appears:



This dialog contains the following functions:

Tabs	
Hub	Displays hub network variables and message tags. Contains functional blocks or supernodes selected prior to opening this dialog and any added using **Add FB/SNs**.
Target	Displays target network variables and message tags compatible with the selected hub.
Connections	Displays connections made with **Add** or **Add All**.
Connection Attributes	
New Connections	Allows you to select a connection description to be associated with new connections made in this dialog. Select **<Default Connection Description>** to use the connection description associated with the hub network variable.
Assign	Assigns the currently selected connection description to the connection selected in the Connections dialog.
Properties	Displays the attributes of the selected connection description. Also allows creating new connection descriptions.
Display	
NV	Displays network variables on the selected shapes if selected.
MT	Displays message tags on the selected shapes if selected. You can only use this option on virtual functional blocks.
Add	Adds the connection to the Connections pane.
Add All	Adds all complementary targets (see description for *Add FB/Sns*).
Add FB/SNs	Adds additional functional blocks or supernodes to the Hub and Target panes. When clicked, the Select Object dialog appears. Select the supernodes or functional blocks you wish to add. Right-click any object to expand, select, and deselect supernodes or functional blocks. Click **OK** when finished.
Graphics	If you selected **Connect** from a connector shape shortcut menu, the connections in the Connection dialog may pertain to several connection shapes. In this case, the graphics mode selection does not affect the existing connections; it affects only new connections you add.
Manual	Displays the connection with connector shapes. Default if one subsystem is selected.
Use References	Displays the connection with reference shapes. Selected automatically if two or more subsystems are selected (see *Using Reference Connections* for more information).
Show Connections	Specifies which connections are displayed in the Connections pane. The options below find and display increasingly more connections.
Selected Connections	Displays only the selected connections.
Selected Connection Targets	Displays all connections to selected targets and displays them.

Between Selected FB/SNs	Displays connections between any of the selected functional blocks and supernodes and displays connection between any pairs.
.... To Selected FB/SNs	Displays all connections from or to all selected functional blocks and supernodes.

Select a single hub on the Hub tab and one or more targets on the Target tab as described in the next two steps. If you wish to connect message tags on these shapes, select **MT**.

2. Click the Hub tab and browse the Hub pane until you find the desired hub network variable or message tag. Click the name or icon of the desired hub. The name is highlighted. If a functional block or supernode containing a network variable or message tag to be connected is not listed in the Hub pane, click **Add FB/Sns** to add it.
3. Click the Target tab. Browse the Target pane until you find the desired target network variable or message tag. Click the name or icon of the target. The name is highlighted. If a functional block or supernode containing a network variable or message tag to be connected is not listed in the Target pane, click **Add FB/Sns** to add it.
4. Click **Add**. This action adds the connection to the connection pane list. Repeat steps 3 and 4 as many times as you wish to create additional targets.

   Or, click **Add All** to add all complementary targets (a network variable or message tag with the same name and same type as the target network variable or message tag in each FB/supernode currently displayed in the Target list) to the connection list. This capability is useful for creating large fan-in or fan-out connections.

   If you wish to add additional functional blocks or supernodes within the Hub or Target panes, click **Add FB/SNs**.

   Specify the desired connection attributes for new connections by selecting a connection description in **New Connections**. You may view the properties of the connection description by clicking **Properties**. See *Using Connection Descriptions*.
5. Click **OK** to create the connection or connections in the LNS network database and drawing.

   If the network is attached and OnNet and the devices participating in the connection have been commissioned (see *Commissioning Devices and Routers*), the connection information in the physical devices is also updated. Otherwise the physical devices are updated when these conditions are satisfied.

Using Reference Connections

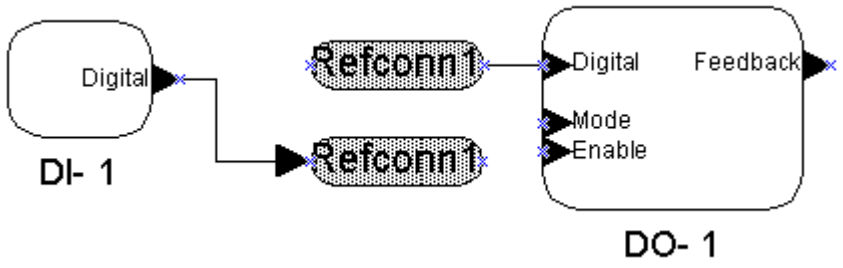
You can connect functional blocks by reference. The network variables or message tags in the connection are connected to a Reference shape. All Reference shapes with the same name are considered to be in the same connection. There is no functional difference between a reference connection and a non-reference connection, only a difference in graphical representation. The default name for the first Reference shape you use is 1. Each subsequent default name increases by one. You can change reference names.

Reference connections are required when functional blocks on different pages are connected. Reference connection may also allow you to simplify your LonMaker drawing when connecting functional blocks from the same page.

You can create, change, or add a connection by reference by completing any of the following steps:

- Create a connection by reference—Set **Use References** in the Connection dialog. This selection causes each end of the connection to be connected to a Reference shape. The Reference shapes created for the connection have the same name, and changing the name of

one changes the name of both or all references in the connection. See the following graphic for an example of a reference connection.



- Change an existing Connector shape to a reference connection—Right-click the Connector shape and select *Use Reference* from the shortcut menu.
- Change an existing reference connection to a connector shape—Right-click one of the references and then click **Don't Use Reference** on the shortcut menu. This option will not be available if the reference connection spans subsystems.
- Add to an existing reference connection—Select the functional block or supernode you want to add to the connection, shift-click the reference shape you want to use, and then right-click the selected shape and choose **Connect** from the shortcut menu. The Connection Properties dialog appears. Use the dialog to add network variables to the connection. For functional blocks and supernodes already connected using the specified reference, the dialog displays only the network variables used in this connection.

Using Connection Descriptions

A *connection description* is a set of properties that apply to a connection. These properties include protocol service, retry count, priority, and authentication. Commonly used connection properties can be assigned to named connection descriptions. The default connection description is **ConnectDescTemplate_0**. The LonMaker tool also provides the following pre-defined connection descriptions:

- **Acknowledged**
- **Unacknowledged**
- **Repeated**

Other connection descriptions may be added and appear in **Connection Attributes** in the Connection dialog.

You can change assigned connection descriptions or create new ones in either of the following two ways:

- Click **Properties** in the Connection dialog to access the Connection Details dialog.
- Right-click the connection and then click **Details** on the shortcut menu.

You can also change an assigned connection description by opening the Connection dialog, selecting a new connection description under **New Connections**, right-clicking the hub network variable or message tag, and then clicking **Assign** on the shortcut menu.

If you select a different connection description, or if you change the attributes of the selected connection description, the LonMaker tool updates all network variable or message tag members of the connection with that new or updated connection description.

See *Connection Properties* for details on creating new connection descriptions.

Using Functional Blocks or Supernodes in Different Subsystems

To connect functional blocks or supernodes in different subsystems, follow these steps:

1. Right-click the functional block containing the network variable that you want to be the hub of the connection, and then click **Connect** on the shortcut menu.
2. Select the hub network variable on the Hub tab.
3. Click the Target hub.
4. Select a network variable that you want to be targets of the connection.

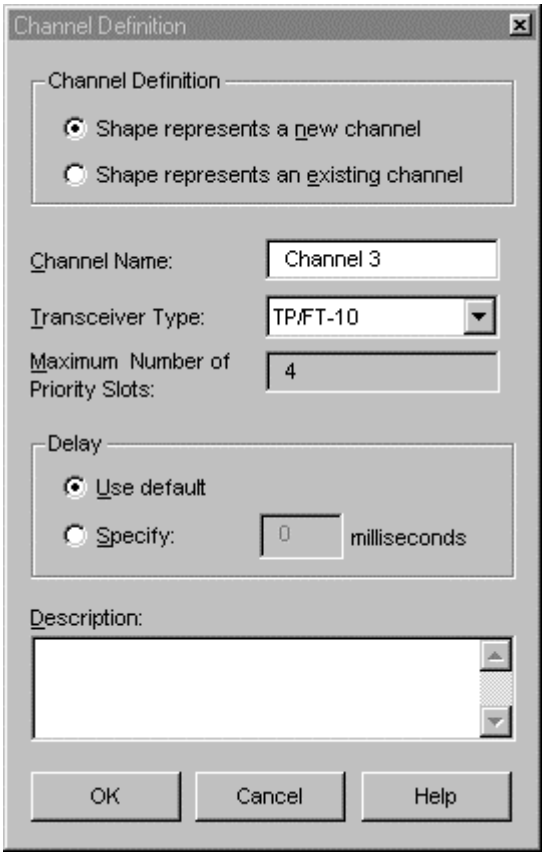
   If the functional blocks or supernodes containing the network variables are not listed on the Target tab, click **Add FB/SNs**. Then, select a functional block or supernode to add and click **OK**. Repeat for each functional block or supernode you wish to add.
5. Click **Add** for that network variable.
6. Repeat this process until you have added all the network variables you want to be targets of the connection.

Creating Additional Channels

When you create a LonMaker network design, it contains one channel named `Channel 1`. You may rename this channel, and you may create additional channels. Multiple channels allow you to use different media within the same network, isolate network traffic for performance, isolate devices for reliability, and increase the number of devices beyond the limit imposed by a particular transceiver technology.

To create a channel, follow these steps:

1. Drag the Channel shape from the LonMaker Basic Shapes stencil to the drawing. The Channel Definition dialog appears:



2. Enter the following information:

Channel Definition

If the channel shape represents a channel that already exists in another subsystem, you may indicate this by selecting **Shape Represents an Existing Channel**. This choice allows you to put devices in different subsystems on the same channel. Each page may have only one Channel shape for each LONWORKS channel, but the same channel may appear on many pages.

Channel Name

If you indicated above that the new channel shape represents an existing channel, this field will contain a list of existing channel names. If this shape represents a new channel, specify a name that is not a duplicate of an existing channel name. This name may contain up to 85 characters.

Transceiver Type

If a new channel is being created this field will contain a list of channel types. Select the one that is compatible with the transceivers to be used on this channel. If a shape representing an existing channel is being created, this field will be set to the channel type of the channel indicated in `Channel Name` and will be read-only.

Maximum Number of Priority Slots

The maximum number of priority slots available on this channel. This field is read-only unless the **Transceiver Type** is set to **Custom**.

Delay	Specifies whether to use the default delay time or to use a specific delay time for the channel in milliseconds. When explicitly setting the delay, the value should be the expected worst-case round trip time of a message (i.e. message and response). This allows expected traffic patterns to be input to the system so that the timer calculations can be affected accordingly. Select **Use Default** to use the default of two packet cycles based on the average packet size.
Description	If a new channel is being created, you may enter a description of the channel in this field. This field has no effect on network operation and may be used to provide additional documentation for as-built reports. If this shape represents an existing channel, you cannot modify this field.

Note: If a channel shape is dropped as part of a master shape that also contains devices, the master shape may limit the channel types that can be used. In that case, only the valid channel names and channel types will be listed.

3. Click **Finish** to create the new channel shape in the LonMaker drawing.

Creating a Router

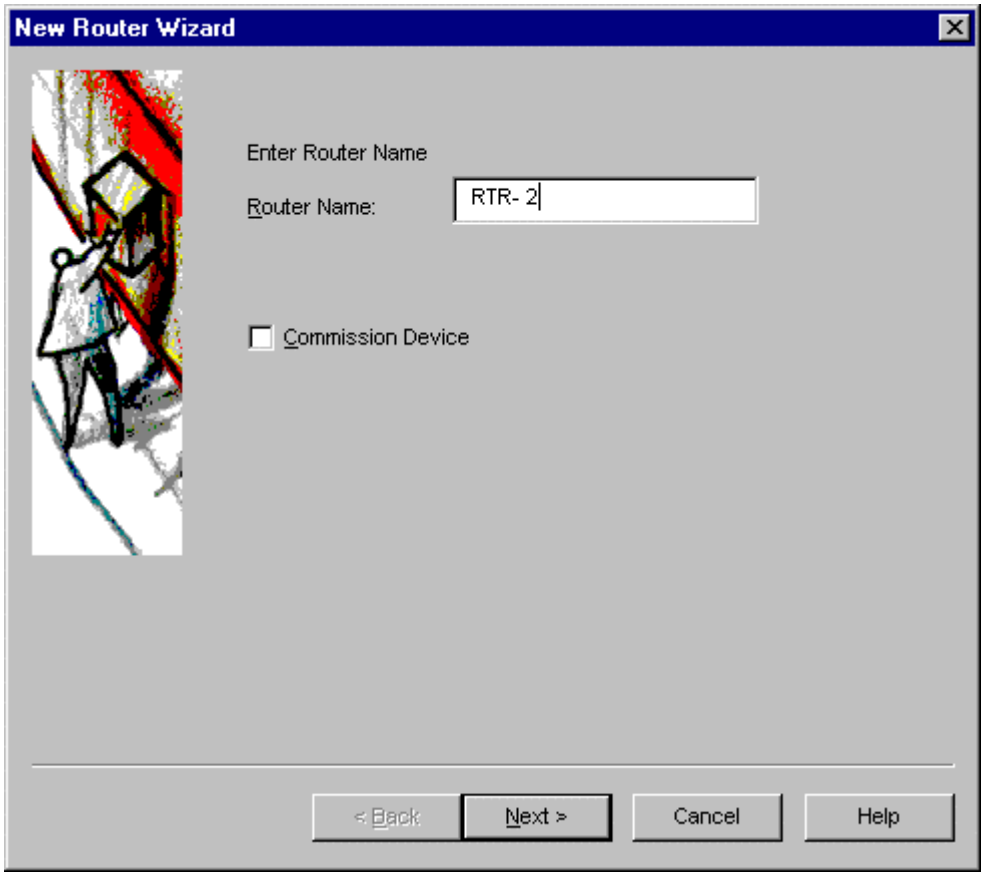
Devices on separate channels cannot communicate unless the channels are connected by a router or an *i*.LON 1000 server. This section describes how to create a router in a LonMaker network design. See *Creating an i.LON 1000 Internet Server* for instructions on that process.

A single router may be used to connect two channels, or you may use multiple routers, called *redundant routers*, between the same pair of channels. Redundant routers provide fault tolerance by providing more than one routing path from one channel to another. They are also required when all devices on a given channel may not be able to hear one another (referred to as an ear shot problem), for example on a radio frequency channel. For a router to function as a redundant router, the router must be configured to be a Configured router (this is the default).

Routers, like devices, are created in two steps: definition and commissioning.

To create a router, follow these steps:

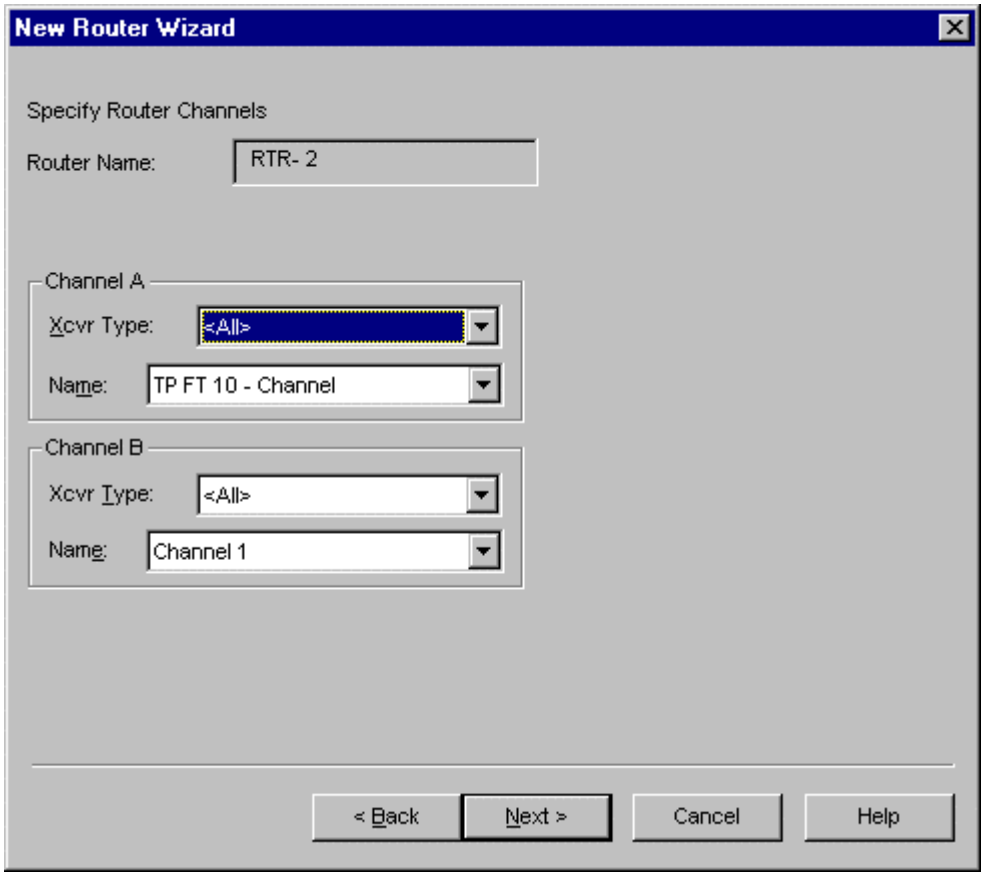
1. Create the channels you want to connect with the new router or make sure that they already exist somewhere in the drawing. The channels being connected do not have to be on the same page as the router.
2. Drag a Router shape from a LonMaker stencil to the drawing. The New Router Wizard appears.



3. Enter the following information:

Router Name	The name of the router. This name must be unique within the network and may be up to 85 characters long.
Commission Device	As when defining a device, you may choose to define and commission the router in the same step. If the LonMaker tool is not attached to the network, the Neuron ID can only be entered manually. You can control the default setting for this field from the **LonMaker** menu by selecting **Network Properties**, clicking LonMaker Options tab, and then selecting **Devices**.

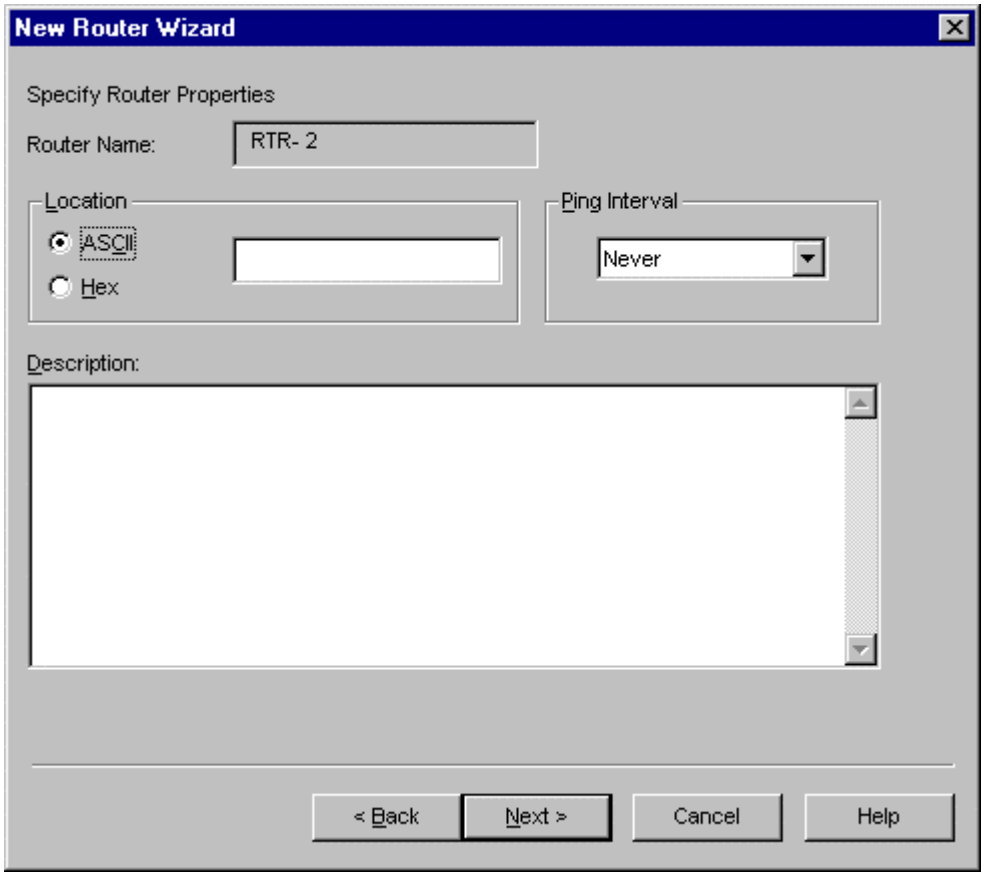
4. Click **Next** to open the following window:



5. Enter the following information:

Xcvr Type	Specifies the channel type for the channels listed in the `Name` list. Only channels with the specified channel type will be displayed. Some router shapes will limit the channel types you can select. Select **All** in the **Xcvr Type** to view all defined channels. The default setting is **All**.
Name	Lists all of the channels for the specified channel type. Select the two channels you wish to link with the router. The same channel cannot be selected in both fields. If one or both of the channels you choose does not have a representation in this subsystem, a shape for it will automatically be added when the router definition is complete.

6. Click **Next**. The Specify Router Properties window appears:



7. Enter the appropriate information in the following fields:

Location

Specifies the router's location string. This information may be entered as an ASCII text string with up to 6 characters or as a hex string with up to 12 hex digits. It documents the router's location within the network. This information is not used by the LonMaker tool, but may be useful for network recovery if you lose your LonMaker drawing and database. For example, you can put an abbreviation of the subsystem name or a subsystem number in **Location**.

Ping Interval

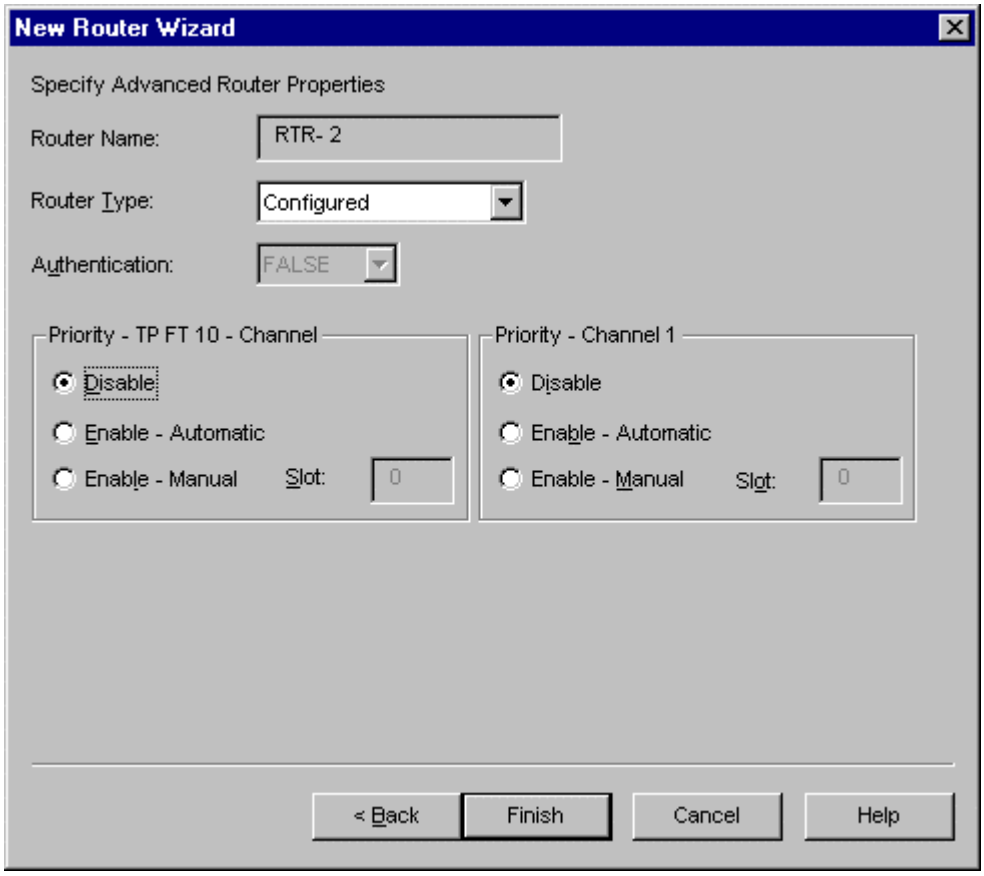
Specifies the ping interval for this router. The ping interval determines how often a router is pinged by the LNS Server to ensure it is still in communication with the network.

Set the ping interval based on the expected attachment of the router to the network. If you expect that the router will never move on the network, select **Never**. Set the interval to `15 minutes` for a router you expect will move rarely, to `2 minutes` for a router you expect will move fairly often, and to `1 minute` for a router you expect will move very often. The default ping interval is `Never`.

Any errors detected by pinging a router are displayed on the router shape in the LonMaker drawing. See *Using LonMaker Styles* for more information.

Description Displays a brief description of the router. This field has no effect on network operation and may be used to provide additional documentation for as-built reports.

8. Click **Next**. The Advanced Router Properties window appears.



9. Enter the following information:

Router Name Specifies the name of the router. This field is read-only.

Router Type Specifies the router type. You can configure a router as one of the following types:

- Configured router
- Learning router
- Repeater
- Permanent repeater
- Bridge
- Permanent bridge

The default type is **Configured**, which is the recommended setting for optimal performance and reliability.

A *Configured Router* determines which packets to forward based on internal

routing tables. Configured routers have their routing tables in non-volatile memory, and thus are retained after a reset. These tables control forwarding of subnet and group-addressed messages and are managed automatically by the LonMaker tool. The LonMaker tool is aware of the network topology, and sets up the subnet and group routing tables accordingly. A configured router is the recommended router type to use, since it allows the LonMaker tool to optimize network traffic and to automatically determine the channel to which each device is attached. Configured routers also support the use of redundant routers (multiple routers connecting the same pair of channels), which provide for redundant message paths and greater system reliability.

A *Learning Router*, like a configured router, determines which packets to forward based on the subnet routing tables. A learning router always forwards all group-addressed messages. Whenever a router receives a packet with a destination address using a subnet ID, it uses the subnet ID to determine whether to forward the packet. Learning routers have their routing tables in volatile memory, so after a reset the router forwards packets addressed to all subnets in the application domain. Whenever a learning router receives a packet from one of its channels, it uses the source subnet ID to learn the network topology. It sets the corresponding routing table entries to indicate that the subnet in question is to be found in the direction from which the packet was received.

A *Repeater* forwards all valid packets received on one channel to the other channel.

A *Permanent Repeater* behaves similarly, but its type cannot be changed after creation.

A *Bridge* forwards a valid packet received on one channel to the other channel if the packet is sent on a domain to which the bridge belongs. In a single domain network, a bridge functions essentially the same as a repeater.

A *Permanent Bridge* behaves similarly, but its type cannot be changed after creation.

Authentication — Indicates whether authentication is enabled for LonMaker communication with this router. Authentication can only be enabled for a router if authentication is enabled for the LonMaker tool in the Authentication dialog of Network Properties.

Priority — Indicates whether priority is used for this router on either or both of its channels, and whether the priority slot will be determined automatically or manually.

If you chose to *Commission the Router* now, the commissioning dialogs appear.

10. Click **Finish** to add the router shape to the LonMaker drawing.

Working With LonMaker Shapes

Viewing and Setting LonMaker Shape Properties

Every LonMaker shape has a Properties dialog that allows you to view, and in some cases change, the properties of the associated object. If the LonMaker tool is attached to the network and the network is OnNet, the changes will immediately be propagated to the physical devices. Otherwise, the changes will be propagated when the network is attached and OnNet. The

properties that may be set and viewed for each type of LonMaker shape are discussed in the LonMaker help file that can be accessed by clicking `Help` in any property window.

Moving a LonMaker Shape

You can move device, functional block, router, subsystem, supernode, and *i*.LON 1000 shapes within a LonMaker drawing.

- To move a shape within a subsystem (page), drag the shape to its desired location.
- To move a device, router, or functional block shape into another subsystem, right-click the shape or shapes you wish to move and then click **Change Subsystem** on the shortcut menu.

  When moving functional blocks that are in connections, you must either move all functional blocks in the connection during the same operation or convert the connections to use references. See *Reference Connections.*
- To move a subsystem, supernode, or *i*.LON 1000 shape into another subsystem, right-click the shape you wish to move and then click **Move** on the shortcut menu. The *Select a Subsystem* dialog appears allowing you to choose the subsystem into which the shape should be moved.

  You can also move devices and routers from one channel to another. See *Changing Channels* for more information.

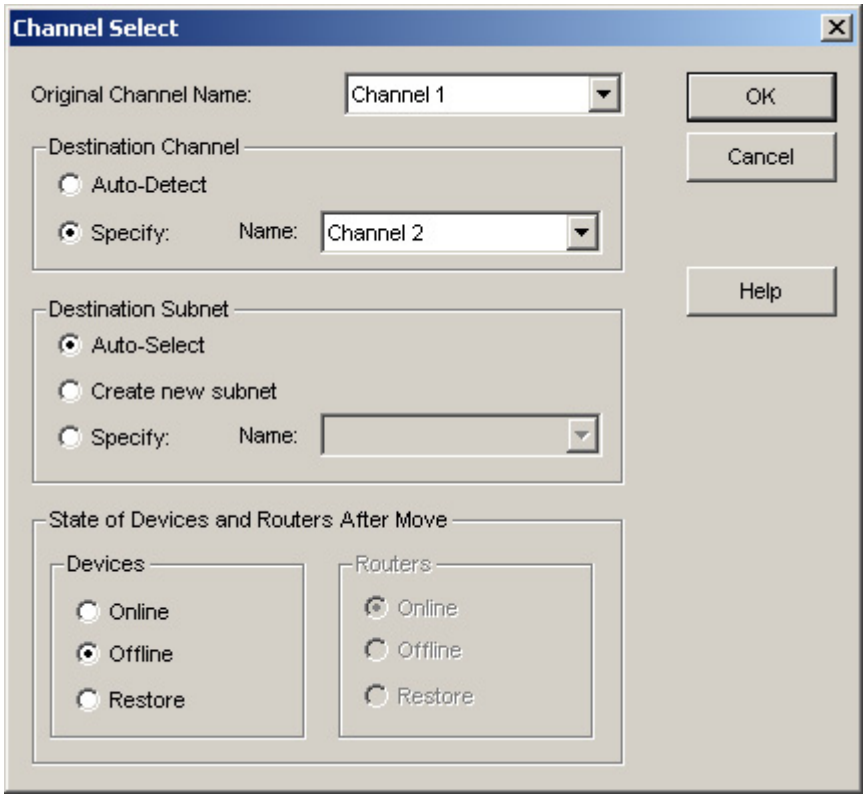
Caution *You cannot move LonMaker shapes using Visio's cut and paste commands.*

Changing Channels

Moving Devices, Routers, and i.LON 1000 Servers

You can move devices, routers, and *i*.LON 1000 server shapes from one channel to another. You can also move a group of devices, routers, and *i*.LON 1000 servers at the same time, as long as they all share a common channel.

Right-click the device, router, or *i*.LON 1000 server and then click **Change Channel** on the shortcut menu. The Channel Select dialog appears.



This dialog contains the following fields:

Original Channel	If you are changing the channel of a router, *i*.LON 1000 server, or multiple devices, all channels are shown and you must select the channel you are changing. Devices that are not on the selected channel are not affected.
Destination Channel	If you are connected to the network and you are changing the channel of application devices only, you can select **Auto-Detect** to have the LonMaker tool automatically move the device or devices to the appropriate channel. Otherwise, you must choose the new channel from the channel list.
Destination Subnet	If you are moving one or more devices, you can select which subnet the device or devices will be on after the move (routers cannot have their subnet changed). Set this option to **Auto-Select** to have the LonMaker tool choose an appropriate subnet. Set this option to **Create New Subnet** to create a new subnet and place the device(s) on it. Set this option to **Specify** to choose an existing subnet from the drop-down menu.
State After Move	Select the desired state of the router, *i*.LON 1000 server, or device after it is moved. The **Restore** option returns the device, *i*.LON 1000 server, or router to its state before the move.

Choose the channel on which to place the device, router, or *i*.LON 1000 server and choose the state in which you want the device, router, or *i*.LON 1000 server after it is moved. If the network is OnNet and any of the devices, routers, or *i*.LON 1000 servers you are moving have been commissioned, the Move Devices and Routers dialog appears:

Physically move the device, router, or *i*.LON 1000 server onto the channel you selected and click **OK**. The LonMaker tool completes the channel change. If the channel change fails, a dialog opens which allows you to recommission the devices, routers, and *i*.LON 1000 servers that you attempted to move.

When moving subsystems that contain devices on more than one channel, only those devices which reside on the original channel will be moved to the new channel. In addition, if the *Exclude Nested Subsystems from Subsystem Operations* option is enabled, only those devices that reside within the subsystem will be moved; devices within nested subsystems will remain on the original channel.

Moving the LonMaker or LNS Server Computer to a Different Channel

To move the LonMaker or LNS Server computer to different channel, complete the following steps for the LonMaker or LNS Server computer:

1. Right-click the LNS Network Interface device for the LonMaker or the LNS Server computer and then click **Change Channel** on the shortcut menu.
2. Follow the prompts and specify the new channel to which the LNS network interface will be attached (see the previous section for more information).
3. If you will be using a different network interface in the LonMaker or LNS Server computer, select **Network Properties** from the **LonMaker** menu and then select the Network Interface tab and select the name of the new network interface.
4. Click **OK**.

Deleting a LonMaker Shape

To remove a LonMaker shape, right-click the shape and then click **Delete** on the shortcut menu. You will be asked to confirm that you want to delete the shape unless you have turned this option off (see the General tab in LonMaker Options in *Network Properties*). When you confirm the deletion, the shape is removed. You cannot delete a channel shape that has one or more devices attached to it.

Removing a device causes all functional blocks associated with that device to be removed. Removing a functional block causes it to be removed from all connections in which it is a member.

If you remove a device with an associated functional block, a message appears warning you that the functional block will be deleted. If you click OK for the warning and then cancel the delete operation, the device remains on the drawing but the functional block is deleted.

Caution *You cannot delete LonMaker shapes using the Delete key or the Visio Cut command.*

Copying a LonMaker Shape

You can copy and paste device, router, *i*.LON 1000 server, subsystem, supernode, connector, channel, and functional block shapes. You can only copy network variable and message tag shapes as part of copying the functional block that contains them. You can only copy connection reference shapes if they are copied in conjunction with the attached Connector shape. When you copying and paste a shape, the LonMaker tool creates a new copy of that shape with properties set identically to the shape it was copied from. For example, if you copy and paste a Device shape, the LonMaker tool creates a new Device shape with an identical device template, configuration properties, and device properties to the first. You must assign each Device shape its own Neuron ID upon commissioning. A copy of a Device shape does not represent the same physical device as the original. Copying a device shape does not copy non-LonMaker extension records.

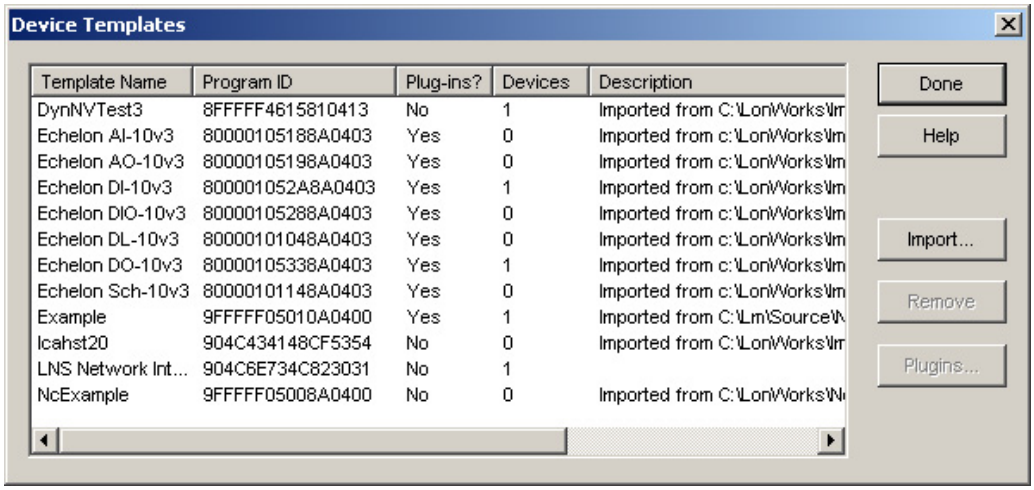
Caution *Copying LonMaker shapes from one LonMaker network to another may not have the desired effect. To copy LonMaker shapes between LonMaker networks, you must first create custom master shapes, and then drag the master shapes into the destination network drawing.*

Using Device Templates

A *device template* is a template used by the LonMaker tool that contains all the attributes of a given device type (functional blocks, network variables, configuration properties, and so on).

Device templates are created using device interface (XIF) files supplied by device manufacturers, or by uploading the interface definition from the physical devices.

You can view a list of all device templates available for your LonMaker network. You can also rename and delete device templates. To manage device templates, select **Device Templates** from the **LonMaker** menu. The Device Templates dialog appears.


Device Templates
Template Name
Program ID
Plug-ins?
Devices
Description
DynNVTest3 8FFFFF4615810413 No 1 Imported from C:\LonWorks\Im
Echelon AI-10v3 80000105188A0403 Yes 0 Imported from c:\LonWorks\Im
Echelon AO-10v3 80000105198A0403 Yes 0 Imported from c:\LonWorks\Im
Echelon DI-10v3 800001052A8A0403 Yes 1 Imported from c:\LonWorks\Im
Echelon DIO-10v3 80000105288A0403 Yes 0 Imported from c:\LonWorks\Im
Echelon DL-10v3 80000101048A0403 Yes 0 Imported from c:\LonWorks\Im
Echelon DO-10v3 80000105338A0403 Yes 1 Imported from c:\LonWorks\Im
Echelon Sch-10v3 80000101148A0403 Yes 0 Imported from c:\LonWorks\Im
Example 9FFFFF05010A0400 Yes 1 Imported from C:\Lm\Source\N
Icahst20 904C434148CF5354 No 0 Imported from C:\LonWorks\Im
LNS Network Int... 904C6E734C823031 No 1
NcExample 9FFFFF05008A0400 No 0 Imported from C:\LonWorks\N
Done
Help
Import...
Remove
Plugins...

You can change device template names in this dialog; all other items are read-only. The following columns are displayed:

Template Name	Specifies the name of the device template. Click the name, wait a few seconds, and then click the name again to change it. The name must be unique for the network. Some customized device and functional block shapes are dependent on a specific device template name, so be sure not to change a device template name if there are any master shapes in any LonMaker stencil dependent on that name.
Program ID	Displays the program ID associated with the device template.
Plugins	Indicates (Yes or No value) whether or not the device template has any associated plug-ins.
Devices	Displays the number of defined devices that use the device template.
Description	Displays a description of the template. By default, this description indicates where the template originated.

You can import a new device template or update a device template that was originally uploaded from a device (additional information may be available in a device interface file such as network variable names and configuration property defaults). To import or update a device template, click the **Import** button. Enter the device interface (XIF) file name in the Import Device Template dialog, or click **Browse** to search for the desired file. When finished, click **Done**.

To remove one or more unused device templates from the list of available templates maintained by the LNS Server, Ctrl-click each template you want to remove, and then click **`Remove`**. Alternatively, you can Shift-click to select a series of adjacent device templates. The LonMaker tool will not allow you to remove a device template currently in use, even if it is in use by a device that has been discovered by the LNS Server but does not yet appear in your drawing. If you remove a template with an associated plug-in and you later re-import the template, you must re-register the plug-in.

For a list of plug-ins associated with a device template, select the template and then click **`Plugins`**. A list of the plug-ins registered for device template appears. To view more information about a plug-in, select the plug-in in the plug-ins list and then click **Info**.

Customizing the User Interface Overview

The LonMaker tool's user interface provides options that allow you to customize the user interface and drawing to meet your needs. The following sections describe these options.

Editing the Title Block

The default LonMaker templates create a title block at the bottom right corner of each page of your LonMaker drawing. The title block provides information about the drawing (drawing title, page number, name of the drawing's creator, date the drawing was created, full file name of the drawing, and a brief description of the drawing or network).

To edit the title block fields, complete the following steps:

1. Open the **Edit** menu.
2. Point to **Go To**.
3. Choose **Background**.
4. Select the part of the title block you want to edit (no cursor appears).

5. Enter the information you want displayed.

To return to the main drawing, open to the **Edit** menu, point to **Go To**, and then choose **Foreground**. The changes you made to the title block are displayed.

Setting the LonMaker User Interface

The LonMaker tool has two User Interface (UI) settings, Minimum UI and Maximum UI. To change your UI setting, open the **LonMaker** menu and select either **Minimum UI** or **Maximum UI**. The default UI setting is Maximum UI.

The Minimum UI setting provides the minimum menus, menu items, and toolbars you need to use the LonMaker tool. The Maximum UI setting provides a full set of toolbars, menus, and menu items for advanced use of the LonMaker tool. You can set the initial UI setting for each LonMaker user as described in *Creating a New User Profile*.

Using LonMaker Demo Mode

You may use the LonMaker tool in demo mode, which is a limited operational mode designed for training or sales demonstrations. If you are using the LonMaker Trial Edition, you can only use demo mode. Demo mode allows you to create demo networks with up to 6 devices without using or *purchasing LonMaker credits*. Demo mode has the following differences from standard mode:

- You cannot use demo mode for production networks.
- LonMaker credits are not used when devices are commissioned.
- The demo network is limited to a maximum of six devices.
- You cannot use remote clients.
- Each page of the demo network is identified by the words “LonMaker Demonstration Network” in the background.
- You can only open the LonMaker drawing in demo mode. It cannot be accessed by the LonMaker tool when it is operating in standard mode.

To create a new LonMaker demo network, set the template from the Options tab in the LonMaker Design Manager window. Set the template to **LonDemo**. Setting the demo template here causes all subsequently created networks to use the demo template. Restore the template setting to create production networks.

Using AutoCAD Drawings Overview

You can import AutoCAD drawings into your LonMaker drawing and export your LonMaker drawing as an AutoCAD drawing.

Importing from AutoCAD

Importing an AutoCAD drawing is useful when you want to use a drawing created by the mechanical system designer as a background for your LonMaker drawing. This allows you to show the physical placement of devices within the mechanical system.

To import an AutoCAD drawing into the background of a LonMaker drawing, follow these steps:

1. Select **Go To Background** from the **Edit** menu.
2. Select **AutoCAD Drawing** from the **Insert** menu.
3. Select the AutoCAD drawing (.dwg or .dxf extension) to be inserted.

4. In the AutoCAD Drawing Layer Status dialog, specify which layers to convert from the AutoCAD file. Since the LonMaker tool only supports importing an AutoCAD drawing as a background, you can choose to convert layers as **Displayed Layers** only. **Layer 0** indicates unlayered data.
5. Specify the drawing page size and scale for the AutoCAD drawing in the Page Size/Scale dialog. These settings do not affect the size of LonMaker shapes in the drawing.
6. Select **Go To Foreground** from the **Edit** menu.
7. The AutoCAD drawing appears in the LonMaker drawing as a background.

Exporting to AutoCAD

You can export a LonMaker drawing to an AutoCAD drawing to create an as-built report in the same format as your other system blueprints. A LonMaker drawing saved in AutoCAD drawing format can be marked up by AutoCAD tools, but not manipulated as an AutoCAD object.

To export a LonMaker drawing as an AutoCAD drawing, follow these steps:

1. Select **Save As AutoCAD Drawing** from the **File** menu.
1. Choose a name for the AutoCAD file. You can export to .dwg format only.
2. In the **Visio Drawing Layer Status** dialog, select the layers you want to export. Click **Options** if you want to select a different AutoCAD output file version or LonMaker drawing mapping scheme.
3. The LonMaker tool saves the drawing in AutoCAD format, and you can open the drawing using AutoCAD software. If your network contains multiple LonMaker drawings, you must export each drawing as a separate AutoCAD drawing to export the entire network.

5

Installing Networks

This chapter covers commissioning devices and routers, and creating a network service device.

Network Installation Overview

When the steps in this chapter (Chapter 5, *Installing Networks*) and in Chapter 4, *Creating Networks* are performed depends on the installation scenario. There are two installation scenarios: *engineered system* scenario and *ad-hoc* scenario.

In the engineered system scenario, all the steps in Chapter 4 (creating subsystem, device, router, *i*.LON server, supernode, functional block, and connector shapers) are performed before any of the steps described in this chapter.

In the ad-hoc scenario, these steps are performed concurrently for each device (for example, a device shape is created and immediately associated with the physical device on the network).

For more information see Chapter 3, *Designing Networks* and the following topics: *Network Installation Scenarios*, *Ad Hoc Scenario*, and *Engineered System Scenario*.

This chapter provides information on the following topics:

- *Commissioning Devices and Routers Overview*
- *Creating a Network Service Device*

Commission Devices and Routers Overview

After you create a device or a router as described in *Creating a Device*, you must commission it to associate the device shape in the LonMaker drawing with a physical device on the network. You can commission devices and routers individually, in groups, or as subsystems.

The process is described in *Commissioning Devices and Routers*.

If you are attached to the physical network and OnNet, you can complete all the required procedures. When a device is commissioned while the LonMaker tool is attached and OnNet, the LonMaker tool associates the Neuron ID with the device; downloads all device configuration, connections, and configuration properties to the device; and deducts a LonMaker credit from your license if you are not using demo mode. A LonMaker credit is not charged when you commission a router. See *Using LonMaker Credits* in Chapter 8 for information about LonMaker credits.

Note: At times you may prefer to commission devices when working unattached from the network or attached and OffNet. This process assigns the Neuron ID, but does not fully commission the device. You must recommission the device when the LonMaker tool is placed OnNet. To recommission a device, right-click the device shape and select *Commission* from the shortcut menu. Go through the commissioning steps. If a Neuron ID has already been assigned to the device, you will not need to reenter it manually or press the service pin. When working attached but OffNet, you also have the option of using the service pin method to identify devices.

You can automatically discover and commission devices using the *Discover Devices* command. See *Discovering Devices* for more information.

The LonMaker tool automatically commissions a device when you replace a device or when you load a new application into a device.

In the ad-hoc network installation scenario, you commission devices as you create them. In the engineered system scenario, you create all devices first and commission them afterwards. If you are using one of the monitoring methods described in *Monitoring Connections*, *Monitoring Network Variables*, or *The LNS Text Box* in any displayed subsystem, you can turn off monitoring to reduce the time required to commission devices.

Commissioning Devices and Routers

The commissioning process involves the following procedures:

- Loading an application image into a device, if necessary
- Setting the initial state of the device or router
- Installing the device or router using the service pin or manual (Neuron ID) method

The processes vary depending on your device or router requirements and whether you are attached to the network and OnNet. The Commission Wizard guides you through the process.

To commission devices and routers, follow these steps:

1. Select the devices and routers to be commissioned. You can select one or more device shapes, one or more subsystem shapes, one or more supernode shapes, or a combination. You can also select a subsystem by right-clicking the page background.

   If devices to be commissioned are on the far side of a router from the network service device, you must commission the router before any such devices.

   When you select a subsystem shape or page, the operation applies to all devices and routers in that subsystem and its dependent subsystems unless excluded by setting **Exclude Nested Subsystems from Subsystem Operations**. Before commissioning a subsystem, you may identify the devices that will be affected by the commission—right-click the subsystem shape or a blank portion of the subsystem page, click **Subsystem Properties** on the shortcut menu, and view the devices listed on the Devices tab.
2. Right-click one of the selected shapes.
3. Select **Commission** from the shortcut menu.

   The Commission Device Wizard starts.

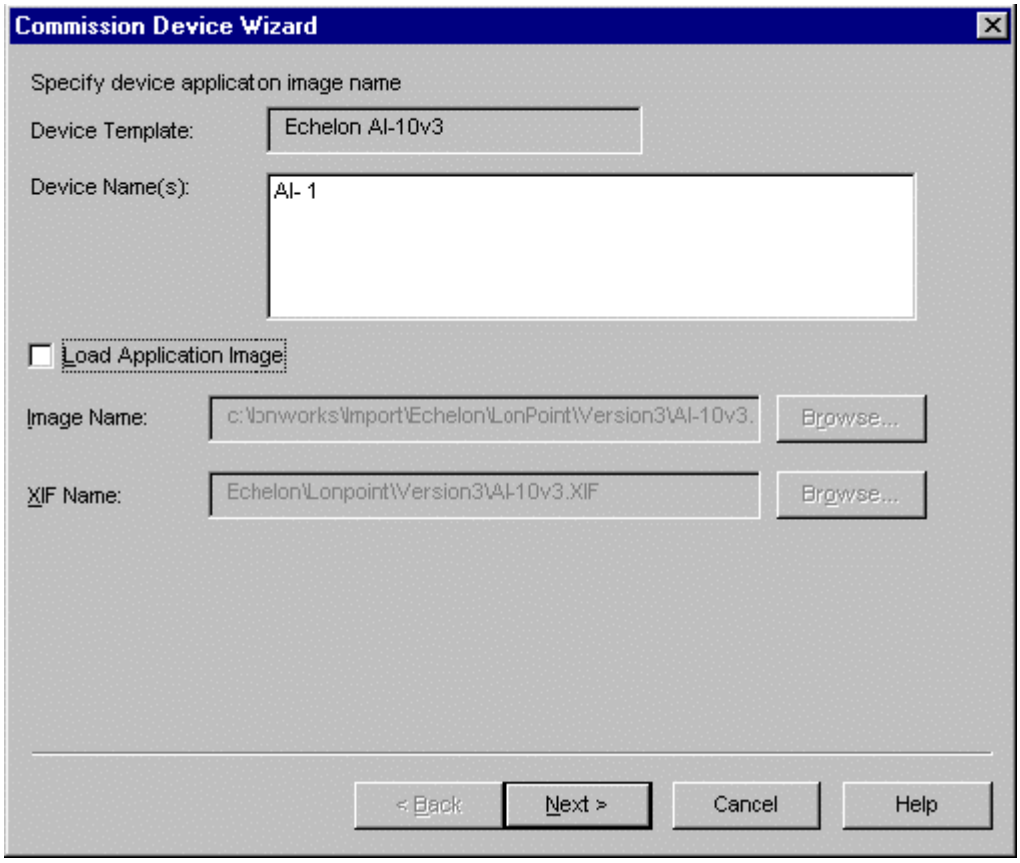
   Select from the following for your next step:

- ❑ If you are attached to the physical network and working OnNet, the Application Image Name window appears. Go to *Loading an Application Image* for directions. Routers do not support application loading. During the load application process, any selected routers are excluded.
- ❑ If you are unattached or attached and working OffNet, the Device Identification window appears. Go to *Installing Devices and Routers*.

Loading an Application Image

This section provides information on specifying the device application image name and selecting the Load Application Image command for commissioning, loading, and replacing devices. The title on the window reflects the process in progress.

If you are connected to the physical network and working OnNet, the Specify Device Application Image Name window (shown below) begins the commission process and is the second step in loading a new application or replacing a device.



As discussed in *LONWORKS Basics*, every device contains an application that determines the behavior of the device. The device may contain the desired application when purchased or it may come with an application file that you may load into the device upon commissioning. You may be prompted to load an application image into a device while you are commissioning, replacing, or loading a new application into the device.

All the selected devices associated with the listed Device Template are shown in this window. Additional windows are shown after you complete selections for this window if the devices you selected have other device templates.

1. Make appropriate selections in the window based on the information provided below.

Load Application Image	Set **Load Application Image** if the device you are commissioning is a Neuron Chip or Smart Transceiver hosted device with writeable application memory and the device comes with an application file (.nxe or .apb extension).
Image Name	Specify the pathname. If you specified a device interface (XIF) file in the Device Template dialog (see *Creating a Device* in Chapter 4) and you are simultaneously creating and commissioning the device, you cannot specify a different device interface file here. If an application image file is found in the same directory as the XIF file of the device template, that directory is the default.
XIF Name	If you are loading an application file with an .nxe extension, select the pathname of a device interface file (.xif extension). The LonMaker tool only requires the binary application file (.apb and

.xfb); however, it automatically creates binary files from existing text files (.nxe and .xif) and saves them in the application file folder containing the corresponding .nxe file.

Note: If you are operating as a remote client (full or lightweight), the LonMaker tool looks for the application files on the LNS Server computer. Be sure to specify the full pathname (including drive) of the application files on the LNS Server. You cannot load an application file directly from a remote client computer to a device.

Caution	*When you load an application image, be sure to verify that the Device Name field contains the name of the device to be loaded to make sure that you are loading the application into the correct hardware device. If the device already has an application, the LonMaker tool will compare the program ID of the new application with the program ID of the application in the device. If both applications use a type 8 or 9 program ID, a warning message is displayed if the device Class or Subclass are different. A warning message is also displayed if a program ID that is not a type 8 or 9 program ID will be overwritten with a type 8 or 9 program ID, or vice versa. If you see this warning, verify that you have the correct device and application. If you do, you can safely ignore the warning message.*

2. Click **Next** to continue. Repeat this process for each device template in the selection. The Setting the Device Initial State window appears.

   Go to *Setting the Initial State* for further instructions.

Setting the Initial State: Devices and Routers

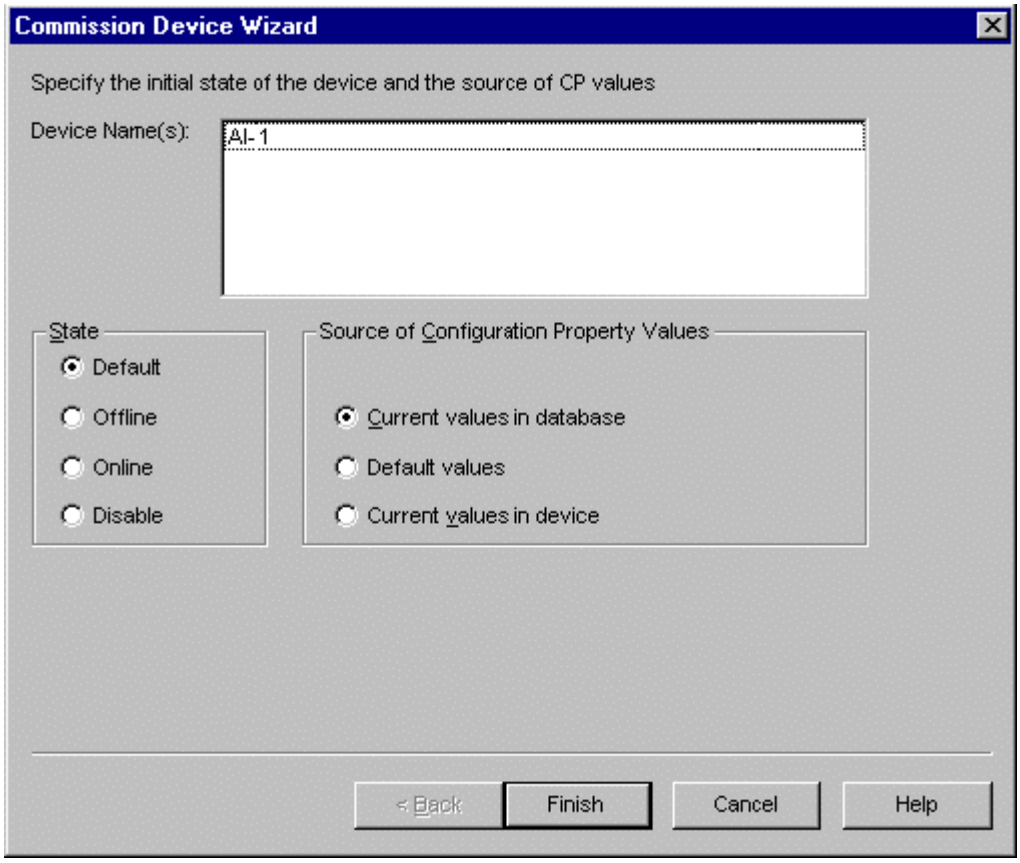
When the LonMaker tool is attached and OnNet, the Device State or Router State window appears when you take any of the following actions:

- Commission, replace, or load devices
- Commission or replace routers

These windows allow you to select the initial state of the device or router and the source of the configuration values for the devices after they are commissioned.

Device Initial State Window

The Device State window (shown below) appears after the Load Application Image process is completed.



1. Specify the initial state of the device and the source of the configuration property values based on the following information:

State	Sets the initial state of the device.
Default	For uncommissioned devices, uses the default state that you selected for new devices in the LonMaker Options tab on the Network Properties window. For commissioned devices, **Default** uses the state of the device prior to the current operation. When replacing devices and routers and the default option is selected, the state is applied as follows: • If the device is currently configured and available, its current state is used. • If the device is not configured or not available and the device master shape defines a default shape, the state of the shape is used. • If the device is not configured or not available, the default new device state is used. This default is specified in the **Device** options of the LonMaker Options tab in Network Properties.
Offline	Sets the device offline so that its application is not running. This option is typically used to bring up devices in an orderly fashion during commissioning. Resetting a device when in the Offline

	state puts the device into the Online state.
Online	Runs the device's application once commissioned. Resetting a device when in the Offline state puts the device into the Online state.
Disable	Keeps the device's application from running even if the device is reset. To be disabled, a device must contain a Node Object functional block. If **Disable** is selected and the device does not contain a Node Object, the device is put into the Offline state.
Source of Configuration Property Values	Specifies the source of initial values for the devices configuration properties.
Current Values in Database	Selects the configuration properties currently set for the device in the LNS network database. This option is disabled when you are creating a new device.
Default Values	Selects the default configuration properties stored in the device template. This option requires a device template based on a version 4 or higher device interface file with default values specified. See the *LONMARK Device Interface File Developer's Guide* in the LNS Utilities and LONMARK Reference help for details.
Current Values in Device	Selects the configuration properties already set in the physical device and uploads them to the LNS network database.

The Replace Device Wizard offers the following three options for the source of configuration property values:

Old Device Values	Uses the same configuration properties settings as the old device as defined in the LNS network database. This option ensures that the new device has the same configuration as the old device.
Default Values	Uses the default configuration properties stores in the device template of the replacement device. This option discards the old device configuration and sets the configuration to the initial default values as defined in the device template.
New Device Values	Uses the configuration properties already set in the replacement physical device and uploads them to the LNS network database. This device also discards the old device configuration and does not change the configuration of the new device. This option is typically used with devices that are configured by the manufacturer.

2. Click **Next** to continue. Your next step is one of the following two options:

- If your selection included routers, the Router State window appears. Continue and make your selections.
- If your selection did not include routers, the *Installing Devices and Routers* step is next. The Specify Identification Method window appears. Go to *Installing Devices and Routers*.

Router Initial State Window

The Router Initial State window (shown below) appears if the objects you selected for commissioning included routers. You may have completed the *Load Application Image* and

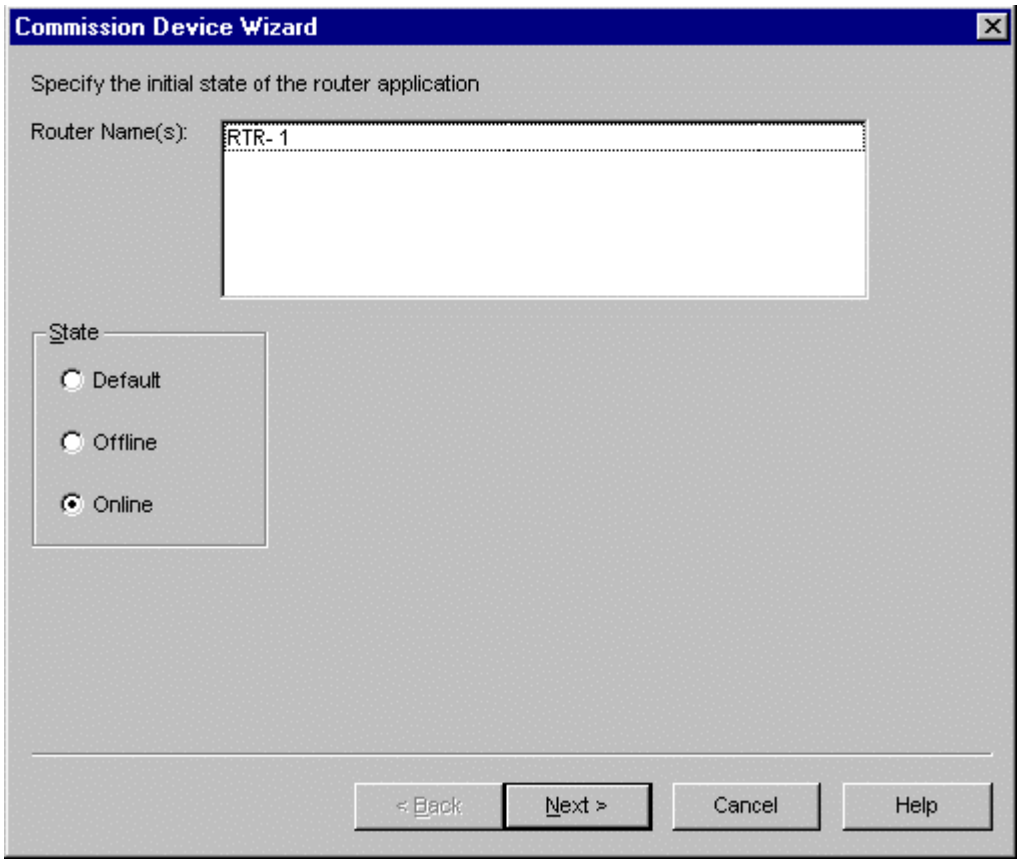
Device Initial State processes or you may have selected routers to be commissioned directly by selecting one or more, right-clicking one and then clicking **Commission** on the shortcut menu.

You can manually commission a router at any time, or you can select the **Commission Device** option when you define the router. The LonMaker tool does not use a LonMaker credit when you commission a router.

If you commission a router when the LonMaker tool is OffNet or not attached to the network, the router will only have its Neuron IDs assigned. You must recommission the router when you put it OnNet, but you do not have to re-enter the Neuron ID manually or press the service pin.

Note: The defaults for this page and whether it is displayed can be set from the Network Properties/LonMaker Options window.

1. Select the initial state of the router application on the Router Initial State window (shown below).



This window allows you to specify the state of the router application after it is commissioned. When the **Default** option is selected, the state is applied as follows:

- If the device is currently configured and may be communicated with, its current state is used.
- If the device is not configured or cannot be communicated with and the device master shape defines a default state, the shape's state is used.
- If the device is not configured or cannot be communicated with, the default new router state is used. This default is specified in the `Device` option of **LonMaker Options** in Network Properties.

Only an Online router will forward packets between its two channels. You can change the application state after commissioning by *managing the router*.

Caution	*You must place routers online if any devices on the far side of the routers (from the LNS Server) are to be commissioned in the same operation.*

2. Click **Next** to continue. The Specify Identification Method window appears. See *Installing Devices and Routers*.

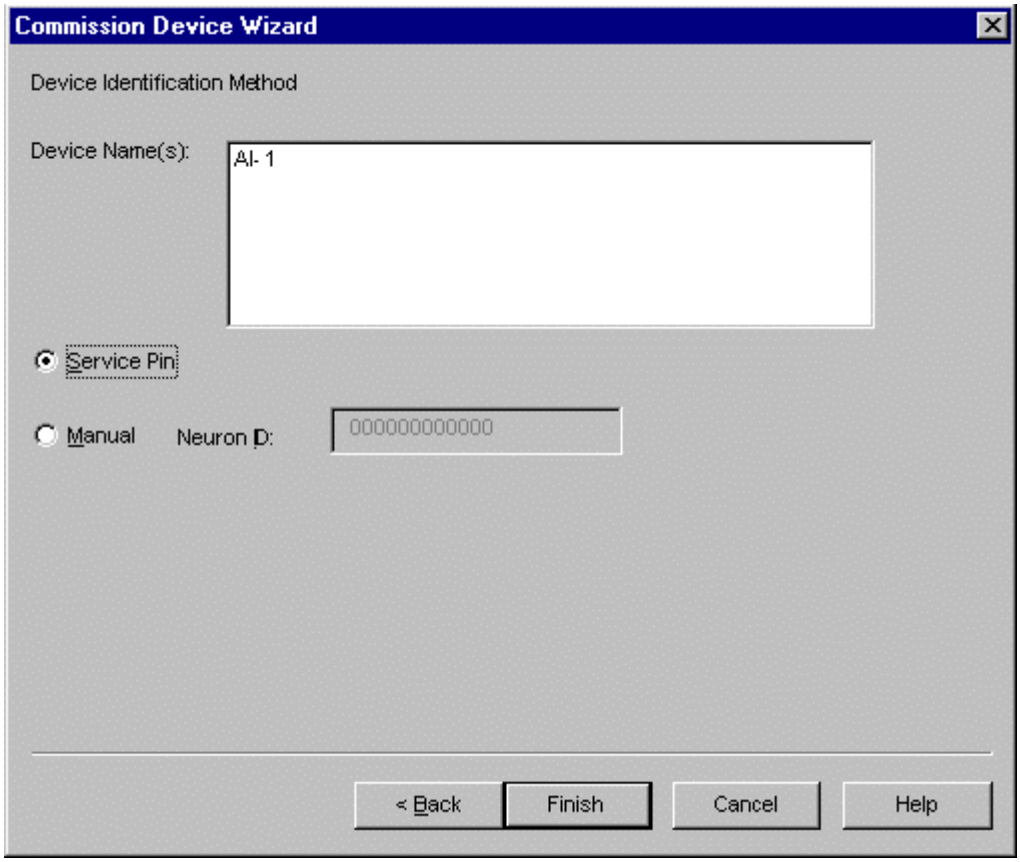
Installing Devices or Routers

This section provides instructions on selecting the Device Identification Method and using the Service Pin or Manual (Neuron ID) method for the commission, load application, and replace processes. The title on the window indicates the process in progress.

The Device Identification Method (shown below) window appears after the device and router states have been set or immediately after the commissioning process is begun if you are not attached to the network or working OffNet. To load an application, you must be working OnNet and loading applies only to devices.

Note: If you are not attached to the network, manual Neuron ID entry is assumed. If only one device is selected, this window is displayed to allow entry of the Neuron ID. If multiple devices are selected, this window is skipped and the window for entering multiple Neuron IDs appears.

Instead of pressing the service pins or manually entering the Neuron IDs, you can use the Discover Devices command to automatically discover Neuron IDs or use the wink method of discovering devices. See *Discovering Devices* in this chapter for more information.



1. Select the method (Service Pin or Manual) for identifying the selected device or devices.

   Information about the window and each method is provided in the following table:

Device Name(s)	Displays the names of the devices that are being commissioned. When commissioning a single device, only the name of that device is displayed.
Service Pin	Allows you to identify the devices by pressing the devices' service pins when prompted. The LonMaker tool reads the Neuron ID from the device service pin message.
Manual	Allows you to enter the Neuron ID of the devices directly. This can be advantageous if the devices are in a difficult to reach location or if you are commissioning many devices in a network installed over a large area. For routers, select this option if the Neuron ID of the near side of the router will be entered by hand or scanned from a bar code. If you choose to commission the device manually, you must enter the Neuron IDs of the physical devices to be commissioned. The Neuron ID of the device will be provided by the manufacturer as a 12-digit hex string or as a bar code label that may be scanned by a bar code reader (see *Commissioning Using Bar Codes* for more information). The Neuron ID field is not displayed if you are identifying more than one device. If you only selected one device or router, enter or scan the Neuron ID here. For routers, this field must contain the Neuron ID of the near side of the physical router to be commissioned or replaced.

2. Click **Finish**.

   If you select the Service Pin method, skip to Service Pin Method.

Manual or Neuron ID Method for Multiple Devices and Routers

If you select the Manual identification method or the LonMaker tool is unattached from the network and you are identifying more than one device, a window showing multiple devices and/or routers appears.

The manual Neuron ID entry window lists all application devices and routers that do not have a Neuron ID assigned. The list contains each device name and device type, as well as a blank field for the device's Neuron ID. The device Neuron ID is provided by the manufacturer as a 12-digit hex string or as a bar code label that can be scanned (see *Commissioning Using Bar Codes* for more information). To enter a device's Neuron ID, click within the **Neuron ID** field for the desired device, and enter its Neuron ID. If you set **Automatically Advance**, the Commission Device Wizard will advance to the next line once a complete Neuron ID has been entered.

Click **Finish** to commission the devices once all Neuron IDs are entered.

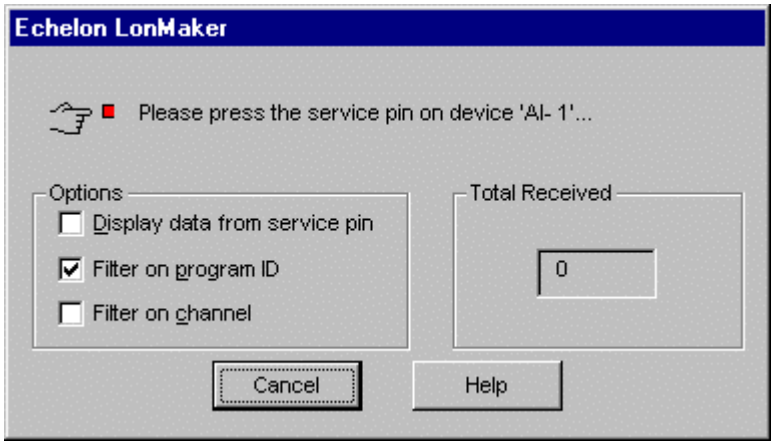
Service Pin Method

If you choose to commission a device with the service pin method, the LonMaker tool prompts you to press the service pin of the physical device after going through the other windows of the Commissioning Wizard. This option is only available if the LonMaker tool is attached to the

network, although not necessarily OnNet. The Service Pin Method provides two windows, one for single devices and one for multiple devices.

Single Device or Router

If you identify a single device and you select the Service Pin identification method, the following window appears:



To identify a single Neuron ID, select from the following options and press the service pin indicated:

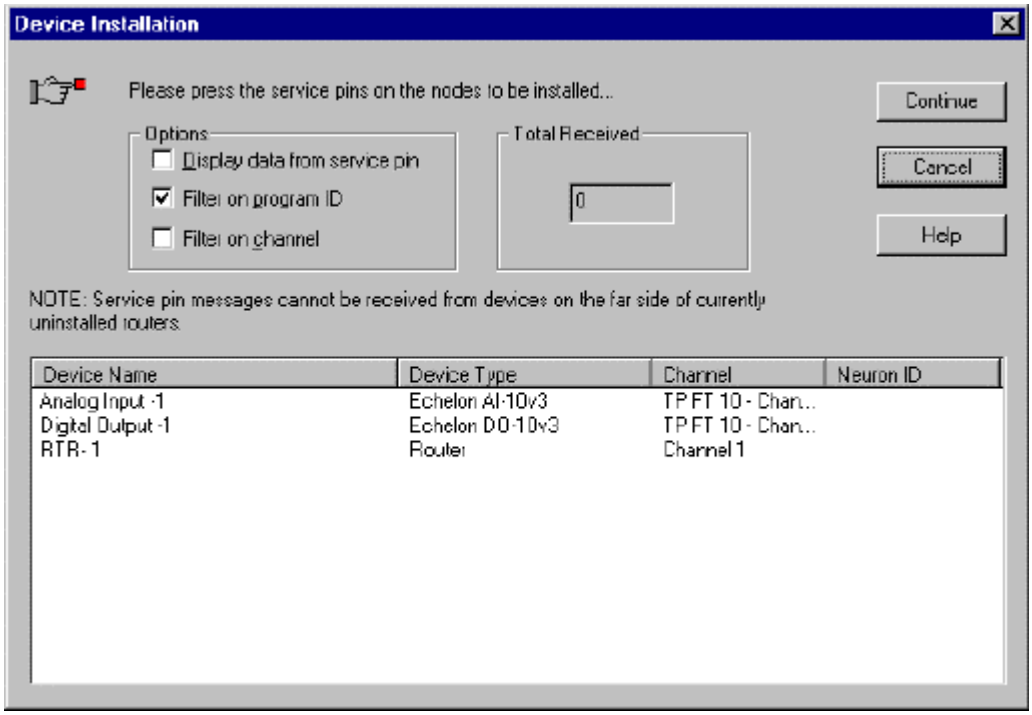
Options

Display data from service pin	Displays a dialog that contains the information returned in the service pin message.
Filter on program ID	Ignores service pin messages that do not include the same program ID as the device being commissioned. Default is selected. This option is cleared if the application image will be loaded during commissioning.
Filter on channel	Ignores service pin messages that do not originate on the same channel as the device being installed. On networks that use repeaters, the LonMaker tool cannot always determine the source channel of the service pin message. For these networks, it may be necessary to clear this checkbox in order to commission the device. The default value is set under the Service Pin category on the LonMaker Options tab in Network Properties.
Total Received	Displays the total number of service pin messages received from any physical device.
Cancel	Cancels the commission process.

When you press the service pin, the LonMaker tool commissions the device and places it in the state you specified.

Multiple Devices or Routers

If you are identifying more than one device and you select the Service Pin identification method, the following window appears:



This window displays the devices to be commissioned in a list. The list contains each device name, type, and channel as well as a blank field for the device's Neuron ID. The Neuron ID of the device will be provided by the service pin message from the device.

To enter a device or router Neuron ID, complete the following steps:

1. Click the name of the device whose service pin will be pressed
2. Press the service pin. If you set the Display Data checkbox, the LonMaker tool displays a dialog containing the information returned in the service pin message.

   If you do not first select a device, the LonMaker tool attempts to automatically match the service pin message with the appropriate device. If multiple devices qualify, the LonMaker tool chooses the first one that does not already have an assigned Neuron ID. To force the LonMaker tool to use a specific device, select that device in the list. If a service pin message is filtered, or the LonMaker tool is unable to identify the device, the Total Received value will increment, but no new Neuron ID will appear in the device list.
3. Click **Continue** to proceed without entering all Neuron IDs (not pressing all service pins for the devices listed, for example). The LonMaker tool proceeds automatically when all Neuron IDs are entered.

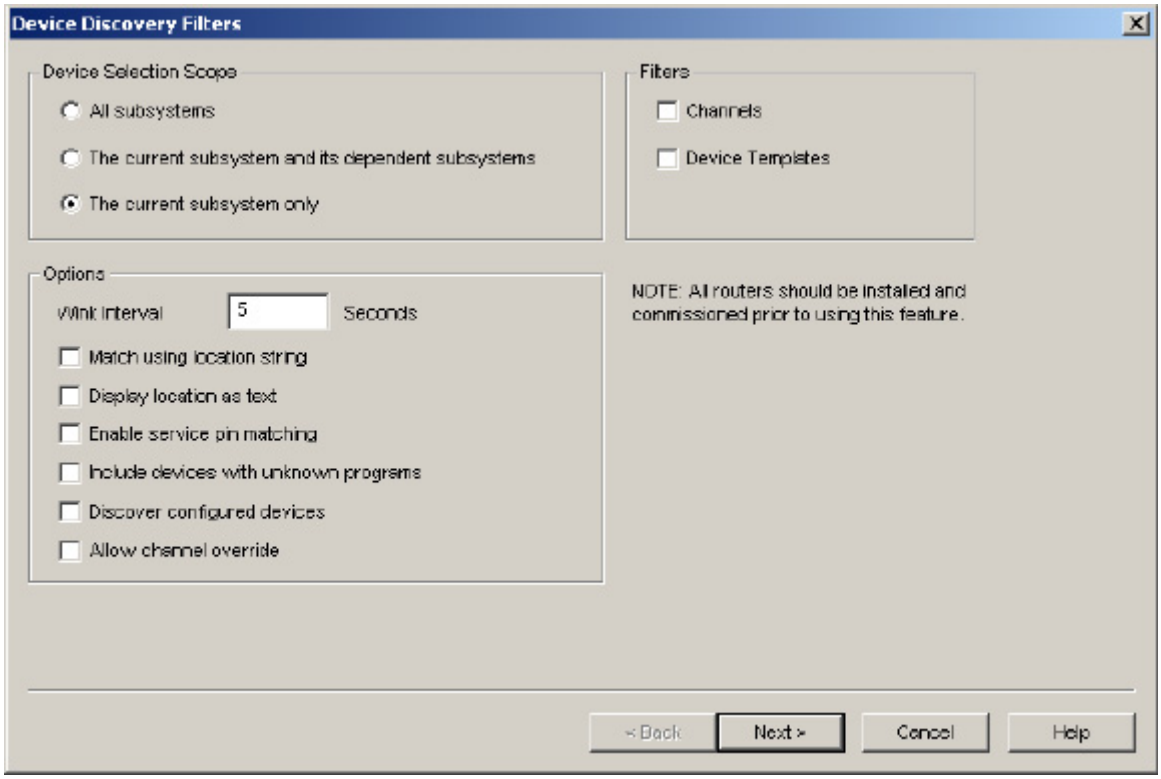
You will return to the LonMaker drawing when the process is complete.

Discovering Devices

You can automatically discover and commission devices using the *Discover Devices* command. This command allows the LonMaker tool to search for devices on the network and match them to uncommissioned device shapes in the LonMaker drawing. This allows you to rapidly commission networks that have been designed off-site as described in engineered system scenario.

You can match discovered devices with your LonMaker device shapes based on their program ID, channel, and location ID. If there is no unique match, you can select the appropriate device by winking or by pressing a service pin. To discover devices, follow these steps:

1. Manually commission all routers as described in *Commissioning a Router*.
2. Select **Discover Devices** from the **LonMaker** menu. The following window appears.



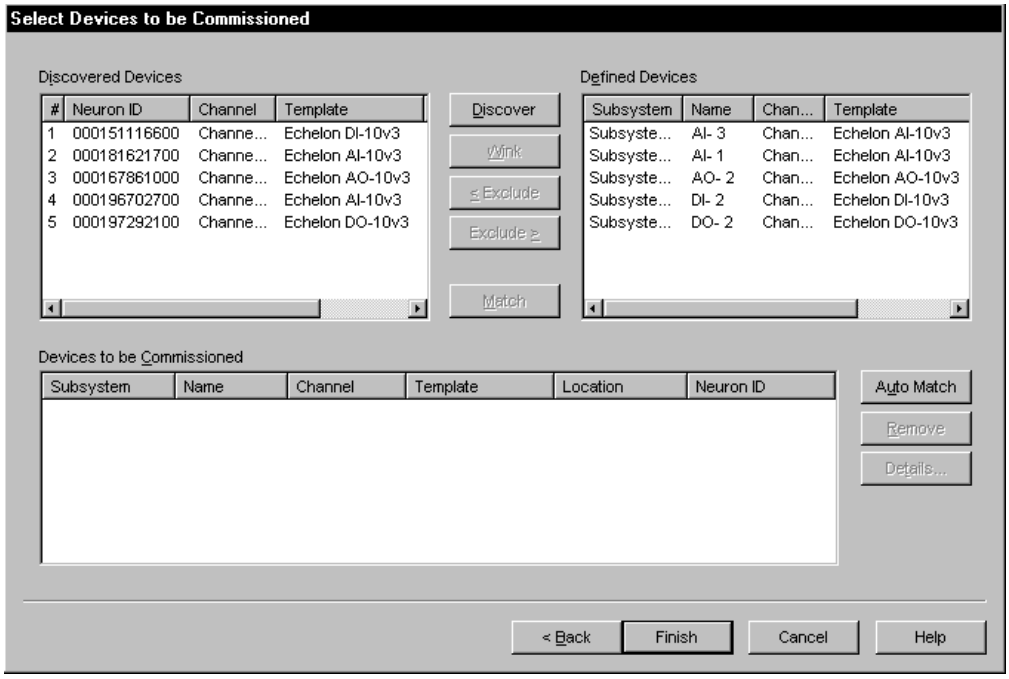
3. Make the following selections:

Device Selection Scope	Selects which subsystems will be searched for uncommissioned device shapes.
Options	
Wink Interval	Specifies number of seconds to wait between winking devices when more than one is selected.
Match using location string	Uses location string, as well as channel and program ID, to match discovered devices with their device shapes through the automatic match feature (see the final Device Discovery window). This option is useful for networks that have a unique location string for each device or if you have a handheld tool that assigns a unique location string to each device.
Display location as text	Interprets location string as ASCII text. Default is to display location string as hex digits.
Enable service pin matching	Matches a device to a defined device by selecting the defined device and pressing the device service pin. The device whose service pin is pressed need not be in the discovered list; therefore, this method can be used to

	commission devices that are in a configured state. However, it may not already be assigned to a different device. You can only select one device in the **Defined Devices** list when you press the service pin.
Include devices with unknown programs	Includes in the discovered device list discovered devices that have an unrecognized application or are without applications. When not selected, they will not be included. A discovered device can be matched to any device that is on the same channel, but must have an application image specified to be loaded (using the **Details** button).
Discover configured devices	Discovers devices that have previously been configured. If you select this option, a dialog appears and you must indicate the domain of the configured devices to be discovered.
Allow channel override	Disregards channel matching during the device matching procedure. If routers configured as repeaters are used, a device may be discovered on the wrong channel. This option allows you to force a match in this situation. If you select this option, you must manually ensure that the device shape and physical device lie on the same channel.
Filters	Limits which devices are discovered based on their Channel or Device Template through a window that appears. This filter also limits devices displayed in *Defined Devices* (see Step 6). Additional dialogs are displayed so you can specify which channels and/or templates are used.

4. Click **Next**. If you select channel or device template filtering, windows appear allowing you to select one or more channels or device templates. Only devices with matching channels or device templates are discovered.
5. Click **Next**. If you set **Discover Configured Devices**, a window appears where you can select the domain on which configured devices will be discovered.

   Note: If you wish to discover configured devices on multiple domains, select the first domain and click **Next**, then click **Back** in the next window to return to this window and select another domain. If there is a router between the LNS Server and the configured device or devices to be discovered, this router must be configured with the same domain as the device or devices to be discovered, unless it is configured as a repeater. If there are configured routers, you can temporarily change them to repeaters, complete the discovery, and then change them back.
6. Click **Next**. The following window appears.



This window allows you to match the discovered devices on the network with the device shapes in the LonMaker drawing. To select a device from any of the device lists, click the entry in the leftmost column of the device listing (i.e. the # column in the **Discovered Devices** list and the Subsystem column in the **Defined Devices** and **Devices to be Commissioned** lists)

If you set **Include Devices with Unknown Programs**, devices may be discovered with no device template. If this happens, discovered devices without applications are shown as Applicationless in the Template column. If a device has a program loaded and there is no corresponding device template, the devices program ID is displayed in hex digits.

This window contains the following buttons:

Discover — Searches for devices. If one or more devices on the network were not discovered, you can force their discovery by pressing their service pin while this dialog is open and then pressing the **Discover** button. This will not cause devices that were removed from the **Discovered Devices** list using the **Exclude** button to be rediscovered.

Wink — Sends a Wink command to the device or devices selected in the **Discovered Devices** list. The action performed by the device is application dependent. Some devices may blink their power LED. This button is only available if one or more devices are selected in the **Discovered Devices** list.

Exclude — Excludes the device or devices selected in the **Discovered Devices** or **Defined Devices** list. The only way to cause a device that has been excluded to reappear on the list is to restart the device discovery process. These buttons are only available if a device is selected in the appropriate device list.

Match — Specifies the device selected in the **Defined Devices** list is to be matched with the device selected in the **Discovered Devices** list. This action removes the device from these lists and adds the

matched device to the **Devices to be Commissioned** list. This button will only be available if one device is selected from each list and the selected devices are compatible.

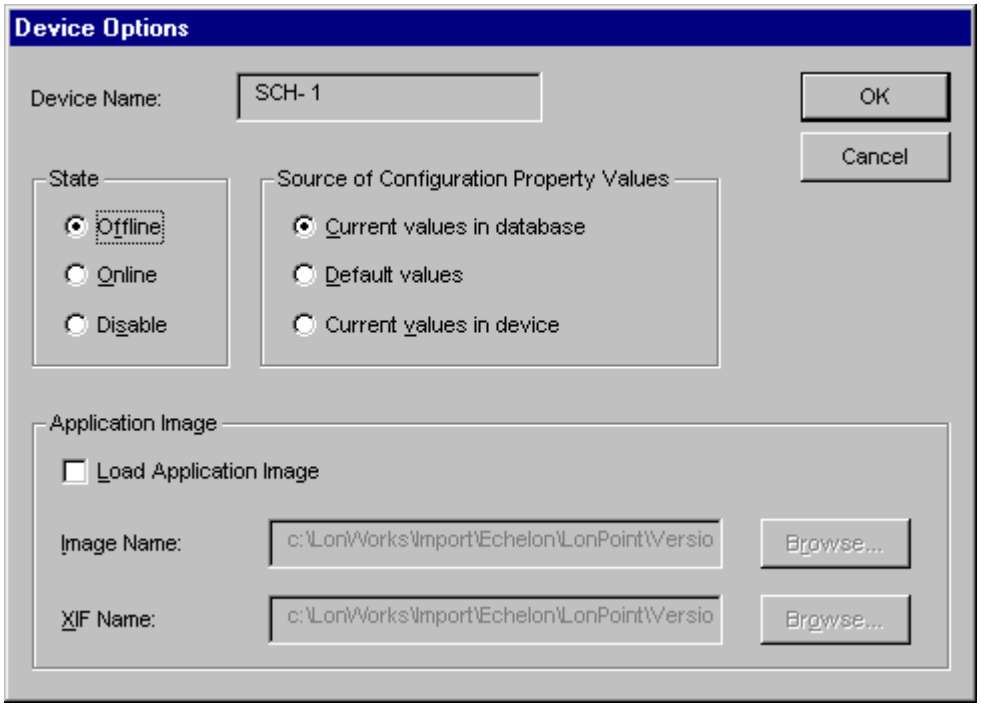
To be compatible, devices must normally have the same device template and channel. If you set **Allow Channel Override**, the channel need not match. If you set **Include Devices with Unknown Programs**, discovered devices without an application or which have an unknown program may be matched to any defined device, but they must have an application selected using the **Details** button before you click the **Finish** button.

If you set **Enable Service Pin Matching**, you may also match devices by selecting a device from the **Defined Devices** list and pressing the service pin of the device to which it should be matched. The defined device must still be compatible with the device whose service pin is pressed.

Auto Match — Matches all discovered devices and defined devices that can be uniquely matched. The LonMaker tool removes them from the **Discovered Devices** and **Defined Devices** lists and places them on the **Devices to be Commissioned** list. In the previous graphic, the AO-10, DI-10, and DO-10 devices would be matched; but the AI-10 devices would not be matched because there is no way to determine which of the two discovered AI-10 devices should be matched to which defined AI-10 device shape.

Remove — Removes the device(s) selected in the **Devices to be Commissioned** list. The device or devices are added to the **Discovered Devices** and **Defined Devices** lists. This button is only available if one or more devices are selected in the **Devices to be Commissioned** list.

Details — Opens the following dialog:



This dialog allows you to set the same options available when commissioning devices one at a time. See *Loading an Application Image* and *Setting the Device's State* for more information.

If you set **Include Devices with Unknown Programs** and a device without an application or that has an unknown program was matched, you must load an application compatible with the defined device using the **Load Application Image** option.

Click **OK** to close the Device Options dialog.

7. Click **Finish** to commission all the devices in the **Devices to be Commissioned** list. Devices will not be commissioned until you select an application image for all devices without applications and devices with unknown applications using the Details dialog.

Commissioning Using Bar Codes

Some device manufacturers, including Echelon for the LonPoint devices, provide a label on their devices that has a bar code containing a Neuron ID. You can use several methods to scan the bar code and save the information to your computer.

A *wedge* interface scanner provides the easiest method of transmitting bar code information from the bar code label to the LonMaker tool. This type of scanner is connected to your computer by a wedge inserted between the keyboard and the system unit. The computer interprets the scanned bar code the same as if you entered the Neuron ID on the keyboard. Most wedge interface scanner vendors supply all necessary cables and connectors along with the scanner itself.

You can choose from three types of scanners, which vary in both price and performance. A gun-style laser scanner is the most expensive, but provides the best accuracy and reliability. Gun-style LED scanners are moderately priced and fairly reliable. Pen-style scanners are the lowest priced, but are not reliable on the fine-line bar codes typically used for Neuron IDs. Check with your scanner vendor for prices on the different scanner types.

If you are using a LonPoint device, or a device with a similar bar code label, using a laser or an LED gun-style scanner is recommended. An example of a scanner that you can use with the LonMaker tool and LonPoint devices is the Symbol Technologies LS 3000, available from Barcode Logics. The Neuron IDs for LonPoint devices are printed on their labels in Code 39 format. See your scanner documentation for instructions on programming the scanner.

Introducing Network Service Device Shapes

Every LNS Server and client computer in a network may be represented by a network service device (NSD) shape in a LonMaker drawing. When a LonMaker network is created, it contains one network service device shape representing the LNS Server. If remote LNS clients are connected to the network, you can add new network service device shapes to represent these clients.

An NSD is a remote client of the LNS Server capable of monitoring and controlling the network. Creating an NSD shape saves you time if you work from a remote full client frequently, because it makes the server permanent. Otherwise, it must be created in the database each time you open the network design and it is removed each time you close it.

After you have added a network service device, you can add a functional block and associate it with that network service device. You can then add network variables and create connections to the functional block as described in *Binding Network Variables to the Host,* and perform management commands on it as described in *Managing Networks*.

To add a network service device shape, follow these steps:

1. Drag the Network Service Device shape from the LonMaker Basic stencil to the drawing.

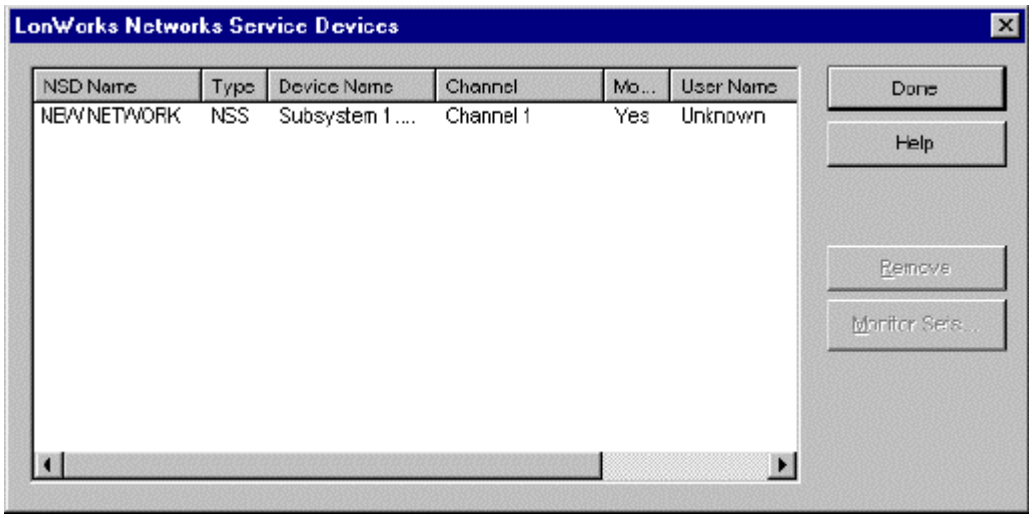
2. A dialog opens which allows you to select whether the network service device being added represents the local network service device (only available if you are a remote client and you are using a network service device that does not have a shape associated with it) or a remote network service device.

3. If you choose **Remote Network Service Device** in step 2, a dialog opens which allows you to select the local or remote network service device to be associated with this network service device shape. If there is only one network service device with no corresponding shape, it will be automatically selected.

If you remove a network service device from the physical network, first remove the network service device shape from the drawing by right-clicking it and selecting `Delete` from the short-cut menu.

Listing Network Service Devices

If you are using the LonMaker tool with remote clients, you can view a list of all LNS clients connected to the network. Each client is represented by a network service device. To obtain a list of all network service devices in a network, select **Network Service Devices** from the **LonMaker** menu. The LONWORKS Network Service Devices window opens.



This window lists all network service devices in this network, regardless of whether a network service device shape has been created for each (see *Creating a Network Service Device Shape*). For each network service device, the following information will be listed:

NSD Name	The name of the network service device. This name is assigned by the LNS Server and cannot be changed.
Type	The type of the network service device. The type can be either NSS (the LNS Server) or NSI (a remote client).
Device Name	The subsystem name and device name of the network service devices in the network.
Channel	The channel on which this network service device resides.
Monitor Sets?	**Yes** indicates that the corresponding network service device has monitor sets defined on it. **No** indicates no monitor sets are defined on that network service device.
User Name	The user name associated with this network service device. See *User*

Profiles for more information on user names.

Application — The name of the application currently active on this network service device. If there is no application, or the application does not provide its name, `Unknown` is displayed. If the network service device is not responding, `**No Response**` is shown.

The **Remove** button allows you to delete the selected network service device from the network. This option is generally used to remove remote network service devices that are no longer in use. Removing network service devices that are no longer in use will improve LonMaker performance.

The **Monitor Sets** button opens a dialog that displays all monitor sets and monitor points currently defined for the selected network service device. To delete one or more monitor sets, select an item in the tree, right-click and then click **Remove** on the shortcut menu.

Upgrading Network Service Device Shapes

When you upgrade the LonMaker Integration Tool or switch between Layer 2 and Layer 5 network interfaces (i.e. LNS network interfaces and fast LNS network interfaces), you must upgrade your network service device. When you open the network and either of these conditions is detected, the LonMaker tool will ask whether you want to upgrade. In most cases, the recommendation is that you perform the upgrade. However, if you are only temporarily using a different network interface, you may choose not to upgrade. In this case, communication with network devices is limited until the network is reopened with the original network interface. If initially you choose not to upgrade the network service device and decide later to upgrade, select the NSD shape, right-click it, and then click **Upgrade NSD** on the shortcut menu.

When moving from an LNS fast (layer 2) network interface to an LNS (layer 5) network interface, all connections and monitor sets may not be created on the new network interface. If this happens, a dialog displays the items that will be lost and gives you an opportunity to cancel the upgrade.

Replacing a Local Network Service Device

When working as a remote full client, you may want your local NSD to assume the configuration (monitor sets, connections, and so on) of another, previously defined network service device. You can do this by replacing a local NSD with the desired NSD shape. The following conditions must be met:

- Your current local NSD cannot have an NSD shape associated with it. If it does, you must first delete the NSD shape from the drawing along with any associated functional block shapes and connections.
- The desired NSD must have a shape in the drawing. If necessary, select one from the template and drag it to the drawing.

When these conditions are met, select the desired NSD shape, right-click it, and then click **Make Local NSD** on the shortcut menu. You have full access to the configuration of the selected NSD.

Caution *The NSD selected must not currently be in use by another remote client. If it is, performing this operation will disconnect the other user from the network.*

6

Maintaining Networks

This chapter describes loading devices, replacing devices and routers, using LonMaker styles, and merging LonMaker networks.

Maintaining Networks Overview

Once your LonMaker network is in place, you can perform routine maintenance tasks to update, repair, and tune the network. You can maintain the network and its components, the drawing, and the database. For example, if a device or router fails, you can replace it in the network while preserving its configuration in the network. In addition, you can synchronize the drawing, database, network, and connections to ensure consistency between these components, as well as merge separate LonMaker networks to support multiple installers or other scenarios that require networks to be initially installed separately. You can load new applications to upgrade devices.

This chapter describes the following maintenance tasks:

- Loading new applications into devices
- Replacing devices and routers
- Decommissioning devices
- Synchronizing the LonMaker drawing, database, network, and connections
- Merging LonMaker databases

If you lose a LonMaker network design (the LNS database or drawing file), the LonMaker tool provides the following two recovery methods:

- Restore from backup files
- Recover the network using the Database Recovery Wizard which creates both a new LNS database and a LonMaker drawing from the physical network

Restoring backup files takes less time and is more complete. For information on these two methods, see *Restoring a LonMaker Network Design* and *Recovering a LonMaker Network Design* in the *Getting Started* chapter.

Loading New Applications Overview

The LonMaker tool can load new applications into devices that have writeable application memory. Like most device operations, you can invoke the Load command on a single device, multiple devices, or a subsystem.

Loading a New Application into a Device or Devices

You can load a new application file (.nxe or .apb extension) into a device, devices, or a subsystem provided the device (or devices) has a writeable application memory and the LonMaker tool is attached to the network and in the OnNet state.

Loading a new application involves the following four procedures:

1. Selecting a device template
2. Loading an application image into a device
3. Setting the initial state of the device and/or router
4. Installing the device or router using the service pin or manual (Neuron ID) method, if necessary

The Load Application Wizard guides you through the process.

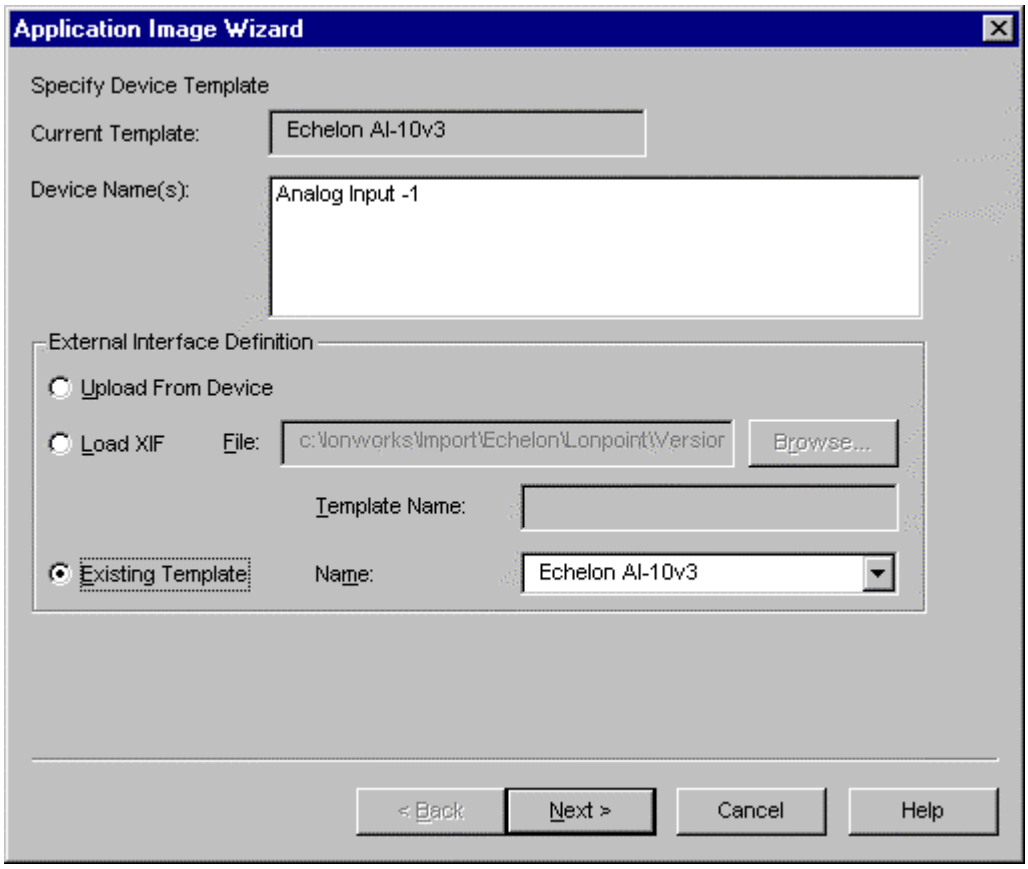
To load an application into a device or devices, complete the following steps:

1. Select the devices. You can select one or more device shapes, one or more subsystem shapes, or a combination. You can also select a subsystem by right-clicking the background of the page.

   When you select a subsystem shape or page, the operation applies to all devices in that subsystem and its dependent subsystems (unless **Exclude from Subsystem Operations** is set). Before loading a new application into a subsystem, you may identify the devices that will be affected by the load process—right-click the subsystem shape or a blank portion of the subsystem page, click **Subsystem Properties** on the shortcut menu, and view the devices listed on the Devices tab.

2. Right-click one of the selected shapes and then click **Load** on the shortcut menu.

   The Device Template window (shown below) appears.



   The Specify Device Template window includes all devices selected with the device template name displayed. You can change the device template associated with a device (due to an upgrade, for example). When you select a new device template, it is applied to all selected devices that use the previous template. The LonMaker tool transfers functional blocks, network variables, message tags, and connections to the new device template. When the transfer is not possible, a dialog appears listing the items that cannot be preserved and giving you the opportunity to cancel the operation.

   You have the following three choices:

- Upload the device template from the device
- Import a device interface

- Use an existing device template

  When uploading from the device or importing a device interface file, you must also specify a unique name for the new template.

3. Select the device template and click **Next**. The default for the Specify Device Template window is **Existing Template**.

   Repeat this process for each device template in the selection.

   When you have selected the last template and clicked **Next**, the application image window appears. Go to *Loading an Application Image* for more information. Loading an application is the same process as commissioning after the Device Template is selected. The *Loading an Application Image* section and subsequent ones show the Commission Wizard windows, but only the title differs.

Replacing Devices and Routers Overview

You can replace a single device or router, multiple devices and routers, or subsystems without changing the configuration of the selected devices and routers. The old device or router may have failed, or a new version of the device or router may have become available. The LonMaker tool allows you to replace a device or router while leaving all functional blocks, connections, configuration properties, and network variables unchanged.

Before replacing a subsystem, verify the devices and routers that will be affected by the replace operation. To determine those devices and routers, right-click within the subsystem, click **Subsystem Properties** on the shortcut menu, and view the devices listed within the Devices tab.

Replacing Devices and Routers

Replacing devices and routers involves the following five procedures:

1. Attaching the replacement devices and routers to the network
2. Selecting a device template for each device
3. Loading an application image into each device, if necessary
4. Setting the initial state of each device and router
5. Installing each device and router using the service pin or manual (Neuron ID) method

The Replace Device Wizard guides you through steps 2 through 5. These steps are the same as the ones described in *Loading an New Application into a Device or Devices*, earlier in this chapter. The Commission process uses steps 3 through 5.

To replace a commissioned device or devices, follow these steps:

1. Attach the replacement device (or devices) to the network. Make sure the hardware settings on the replacement physical device are identical to the old one. If the old device still functions, and if physically possible, leave the old device connected to the network until the replace operation is complete. This will allow the LonMaker tool to deconfigure the old device while configuring the new one. Alternately, decommission the old device before replacement.
2. If you are monitoring the device to be replaced as described in *Monitoring Connections*, *Using the LonMaker Browser*, or *The LNS Text Box*, turn off monitoring.
3. Select the devices and routers to be replaced. You can select one or more device shapes, one or more subsystem shapes, or a combination. You can also select a subsystem by right-clicking the page background.

When you select a subsystem shape or page, the operation applies to all devices and routers in that subsystem and its dependent subsystems unless excluded by setting **Exclude Nested Subsystems from Subsystem Operations**. Before commissioning a subsystem, you can identify the devices that will be affected by the commission—right-click the subsystem shape or a blank portion of the subsystem page, click **Subsystem Properties** on the shortcut menu, and view the devices listed on the Devices tab.

4. Right-click one of the selected shapes.
5. Select **Replace** from the shortcut menu. The Specify Device Template window appears. Go to *Loading an Application Image* described in Chapter 5, *Installing Networks* for further instructions. The Replace Wizard guides you through the remaining steps. Example windows in these sections have different Wizard titles, Commission or Application Image, but the content is basically the same.

To replace a device that is not yet commissioned (to change the device template, for example), complete the following steps:

1. Right-click the device shape and then click **Replace** on the shortcut menu to open the Device Template window
2. Select the new device template, or it may be created from a device interface file (.xif extension). The default is the current device template.
3. Click **Finish** to replace the device template.

NodeBuilder Users: If you are using a NodeBuilder device shape, you cannot replace an uncommissioned device, since the LonMaker tool will not allow the device template of a NodeBuilder shape to be changed.

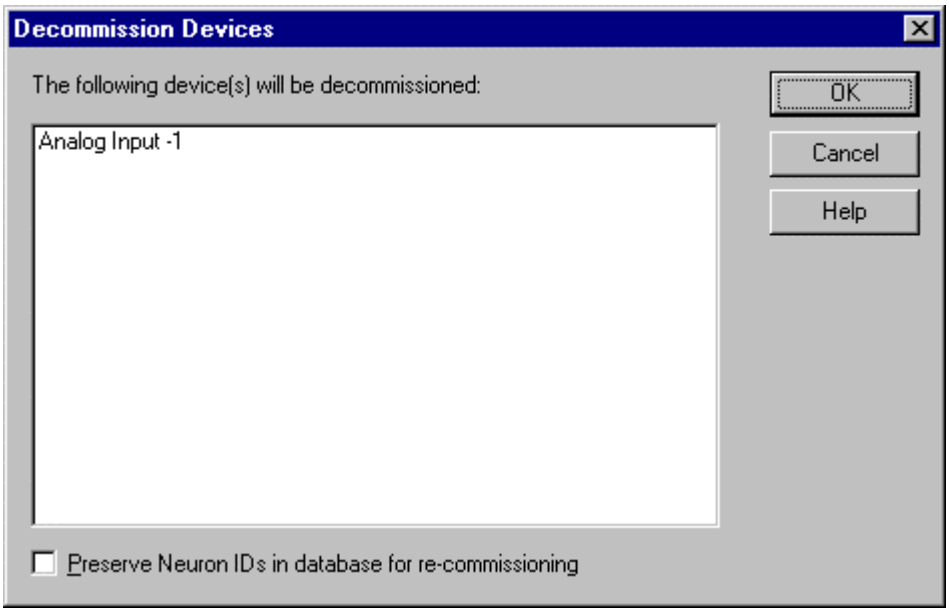
For more information on the Specify Device Template window, see *Loading an Application Image* in Chapter 5, *Installing Networks*.

Decommissioning Devices and Routers

You can decommission (uninstall) one or more devices or routers. This capability is useful when you are making changes to your network, troubleshooting, or conducting demonstrations or training sessions. The LonMaker tool allows you to preserve the Neuron ID in the database if you subsequently wish to recommission the device. However, by default, the option to preserve the Neuron ID is not selected. All configuration information, including configuration properties and connections, are preserved in the database. Therefore, you can later re-commission the same or different devices without re-entering the configuration data. You must be attached to the network and OnNet to decommission devices and routers.

To decommission devices, complete the following steps:

1. Right-click the device, router, or subsystem shape or shapes, or the subsystem page containing the objects to decommissioned.
2. Select **Decommission**. The Decommission Devices dialog appears.



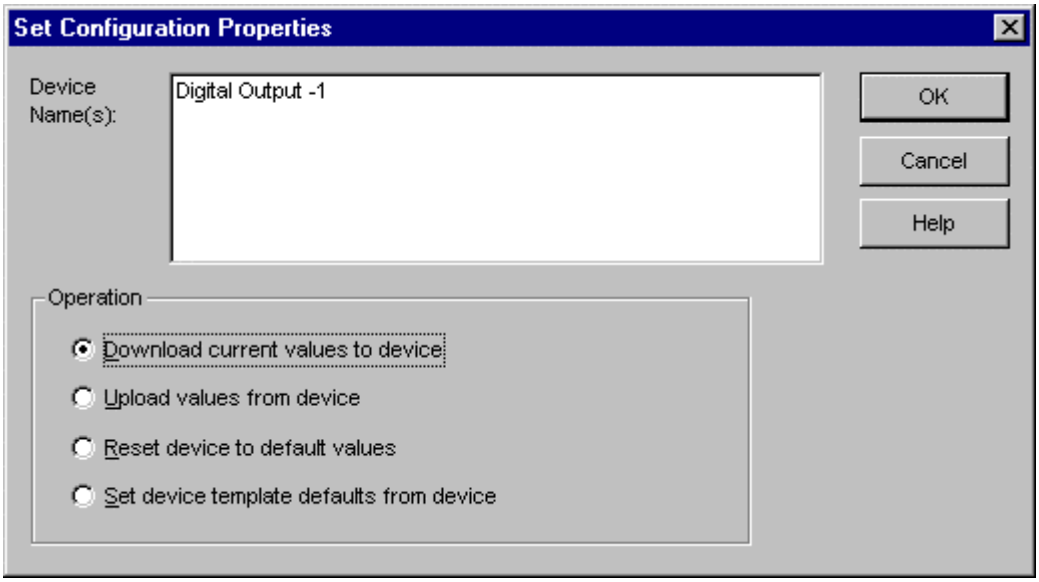
3. Set **Preserve Neuron ID** if you want to recommission the same device or router later.
4. Click **OK**.

Resynchronizing Configuration Properties

The configuration properties in the LNS network database may become unsynchronized with the configuration properties in the physical devices if a non-LNS configuration tool is used on the physical devices, or if the devices themselves update their own configuration properties. If you are resynchronizing configuration properties for multiple devices in a subsystem, see *Updating Multiple Subsystem Devices* in Chapter 4, *Creating Networks* for a faster procedure.

To resynchronize the configuration properties in a physical device with the configuration properties for that device in the LNS network database, follow these steps:

1. Select the desired devices and subsystem shapes.
2. Right-click one selected shape and then click **Resync CPs** on the shortcut menu. The Set Configuration Properties dialog appears.



3. Select one of the following options:

Download	Downloads configuration property values from the LNS network database to the physical device overwriting any configuration changes in the device.
Upload	Gets the current configuration property values from the physical device and saves them to the LNS network database overwriting any configuration changes in the database.
Reset	Resets the configuration properties in the device to the default values defined in the device template, overwriting any configuration changes in the device.
Set	Resets the default configuration property values in the device template using the current values in the physical device. Also updates the configuration property values in the LNS network database, overwriting any configuration changes in the database.

4. Click **OK**. The LonMaker tool updates the device and the LNS network database, as required.

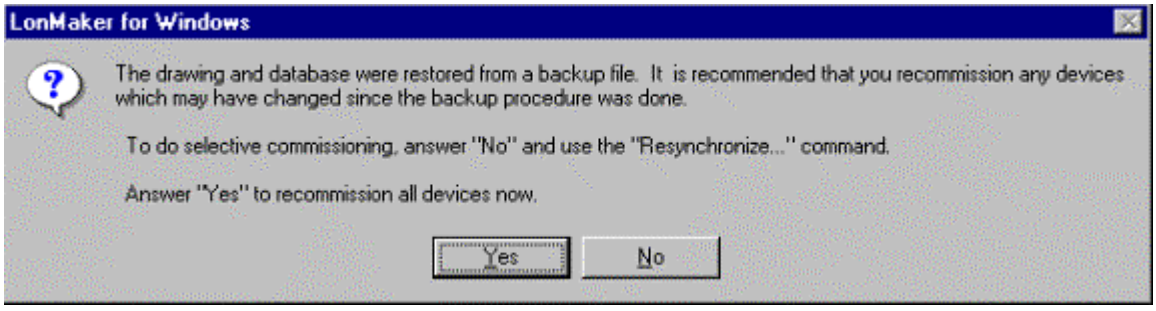
Recommissioning a Network After Restore

You will be given the option to recommission a network when restoring a LonMaker network as described under *Restoring a LonMaker Network*.

Caution	*Recommissioning a device may temporarily disrupt the operation of the device. Be sure to recommission when your network can tolerate brief interruptions of service.*

When recommissioning the network, the LonMaker tool places the network OnNet. When the process is complete, the network remains OnNet.

The first time you open your network design after restoring the database from a LonMaker backup file, the following dialog appears:


LonMaker for Windows
The drawing and database were restored from a backup file. It is recommended that you recommission any devices which may have changed since the backup procedure was done.
To do selective commissioning, answer "No" and use the "Resynchronize..." command.
Answer "Yes" to recommission all devices now.
Yes
No

Click **Yes** to recommission the entire network. This begins the process described in *Resynchronizing the Drawing, Database, and Network*.

Note: You can skip the recommissioning process if there were no changes to the configuration of the existing physical devices since backing up the network. This happens if the network was OffNet the entire time, or if you added new devices and functional blocks but did not modify existing devices or functional blocks. If you added and commissioned new devices after you backed up your network and before you restored the backed-up copy, recommissioning the network does not alter the new devices. You can redefine and commission those devices so that they communicate properly with existing devices after you have restored and recommissioned your network.

You can also initiate recommissioning by selecting *Resynchronize* from the LonMaker menu.

Resynchronizing the Drawing, Database, and Network

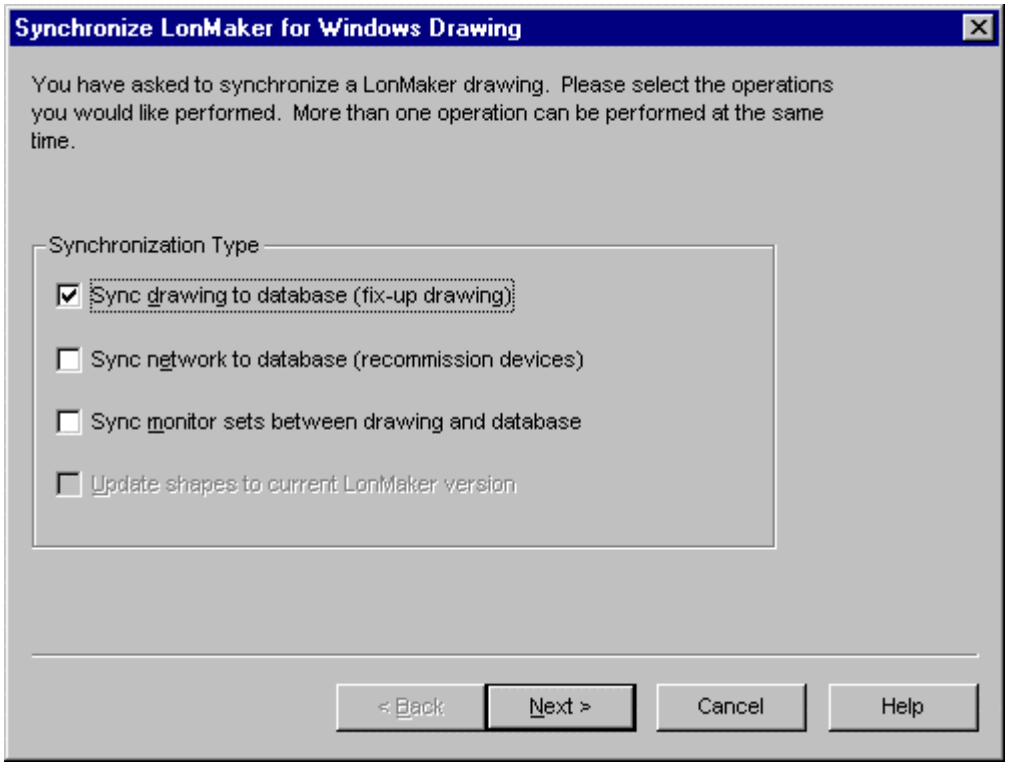
A computer failure or modification of the LNS network database by applications other than the LonMaker tool can cause a LonMaker drawing to be out of synchronization with the associated LNS network database. For this reason, you can resynchronize the drawing to the database. Additionally, the resynchronization command provides a convenient method for resynchronizing physical devices with the LNS network database—for example, to recommission all devices on the network.

Both types of resynchronization always use the information in the LNS network database to resolve any inconsistencies. For example, if the database contains devices that are not in the drawing, the devices are added to the drawing during drawing resynchronization.

Note: If you have an LNS network database but not a LonMaker drawing file, you can create a drawing from the database. Open the Design Manager, select the database name, and select **None** for the drawing name. Click **`Create Drawing`**. For more information, see *Creating a Drawing from an LNS Database* in Chapter 2, *Getting Started*.

To resynchronize the drawing or network, complete these steps:

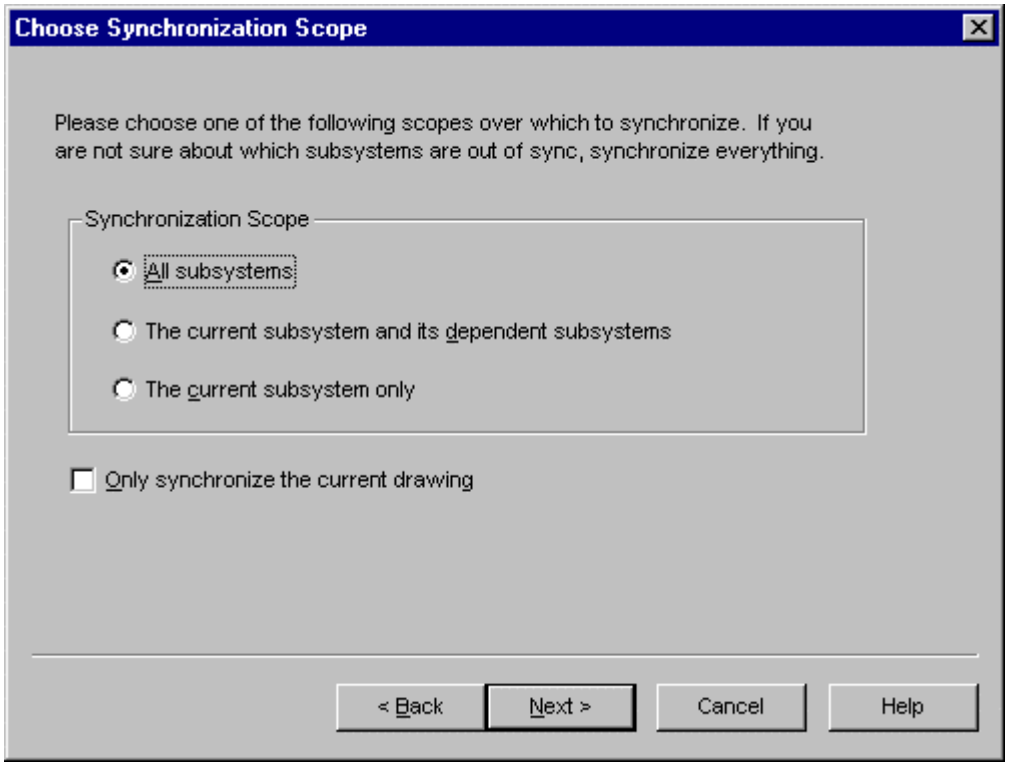
1. *Back up the LonMaker network* to allow you to recover from a resynchronization error.
2. Open the **LonMaker** menu and select **Resynchronize**. The Synchronize LonMaker for Windows Drawing window appears.


Synchronize LonMaker for Windows Drawing
You have asked to synchronize a LonMaker drawing. Please select the operations you would like performed. More than one operation can be performed at the same time.
Synchronization Type
Sync drawing to database (fix-up drawing)
Sync network to database (recommission devices)
Sync monitor sets between drawing and database
Update shapes to current LonMaker version
< Back
Next >
Cancel
Help

3. Choose any combination of the following options:

Sync drawing to database	Modifies the drawing to be consistent with the LNS network database.
Sync network to database	The physical devices will be configured and commissioned to be consistent with the LNS network database.
Sync monitor sets between drawing and database	Updates the monitor sets to be consistent with the LonMaker drawing. If the type or format of monitored points has changed, this will update the value displayed when the point is monitored using the LonMaker tool. See the *Glossary* for a definition of monitor sets.
Update shapes to current LonMaker version	If the LonMaker drawing was originally created with an earlier version of the LonMaker tool, the shapes will be updated to reflect the current release of the LonMaker tool.

Once you have chosen the type of resynchronization you wish to perform, click **`Next`**. The following window opens:

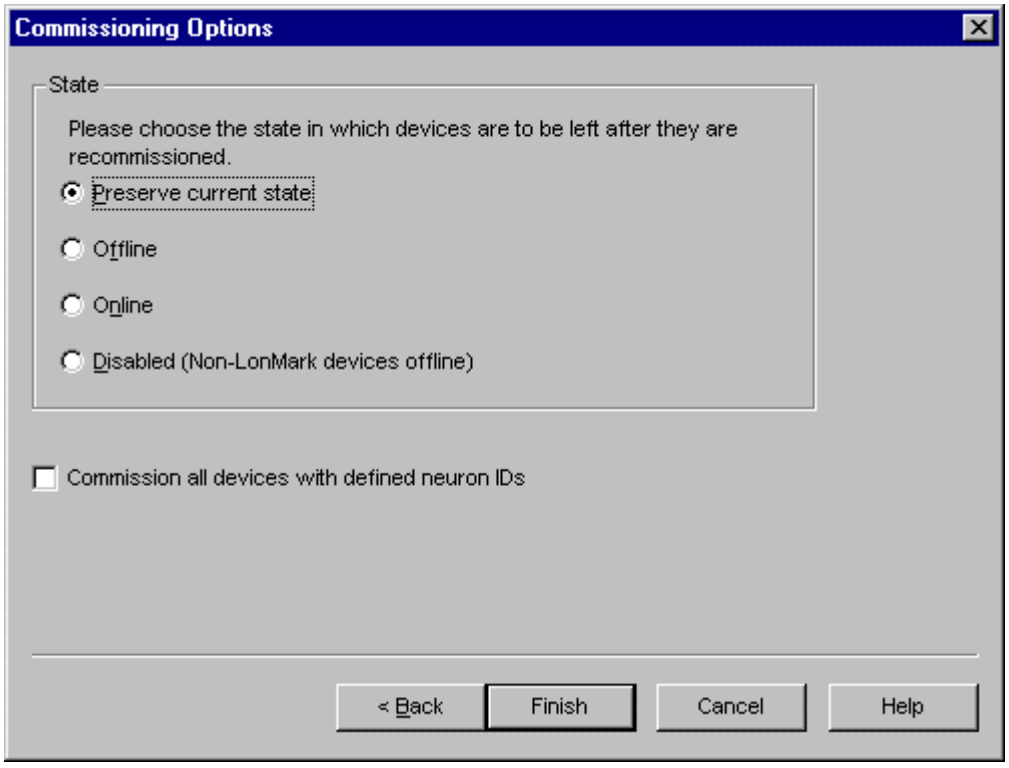

Choose Synchronization Scope
Please choose one of the following scopes over which to synchronize. If you are not sure about which subsystems are out of sync, synchronize everything.
Synchronization Scope
All subsystems
The current subsystem and its dependent subsystems
The current subsystem only
Only synchronize the current drawing
< Back
Next >
Cancel
Help

4. This window allows you to determine the scope of the resynchronization. If you know the drawing or network is only out of synchronization for one subsystem in a system that contains several subsystems, you may choose to resynchronize only that subsystem to save time. If you aren't sure what has become unsynchronized, resynchronize the entire drawing.

   If the LonMaker network you are resynchronizing contains multiple drawings (see *Creating a Subsystem*), setting **Only Synchronize the Current Drawing** prevents the LonMaker tool from attempting to resynchronize any drawing files but the current one. If you are unsure which drawing files may be out of sync, clear this option.

   Click **Next**.

5. If you set **Sync Network to Database**, the following window appears.

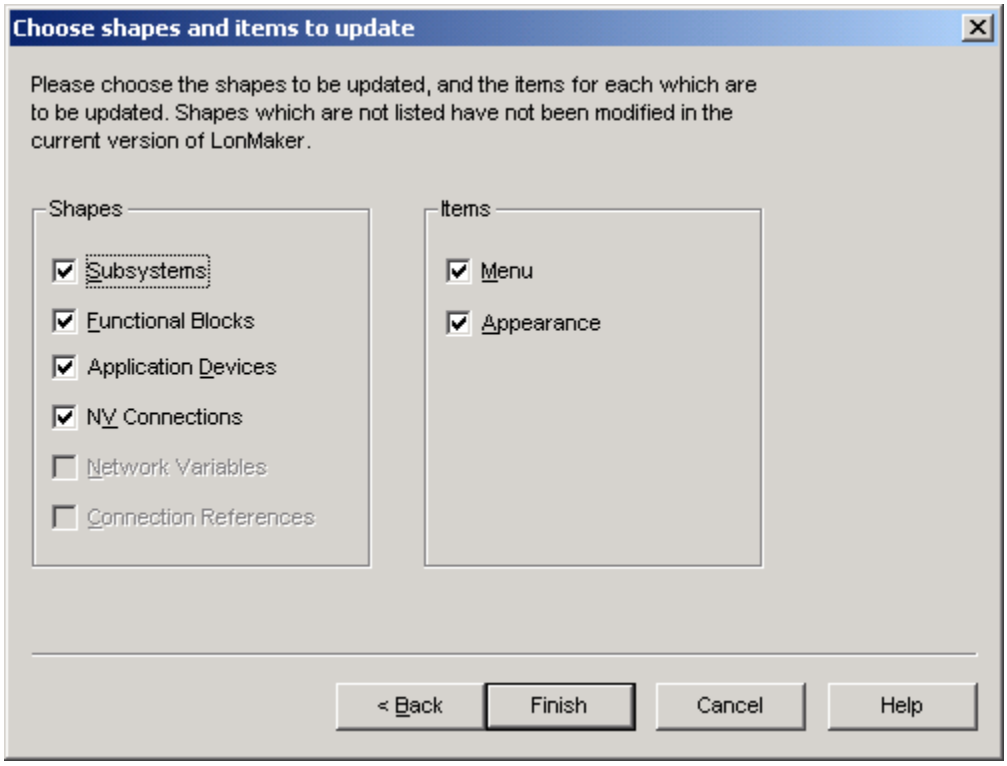


Select the state of the devices after the resynchronization is complete.

Set **Commission all Devices with Defined Neuron IDs** if you entered Neuron IDs and want all those devices commissioned. If clear, only devices that were previously commissioned are recommissioned now.

If you select **Preserve Current State and Commission all Devices with Defined Neuron IDs**, the state of devices that have not been previously commissioned is based on the setting in the Network Properties>LonMaker Options>Device Options>New Device State dialog.

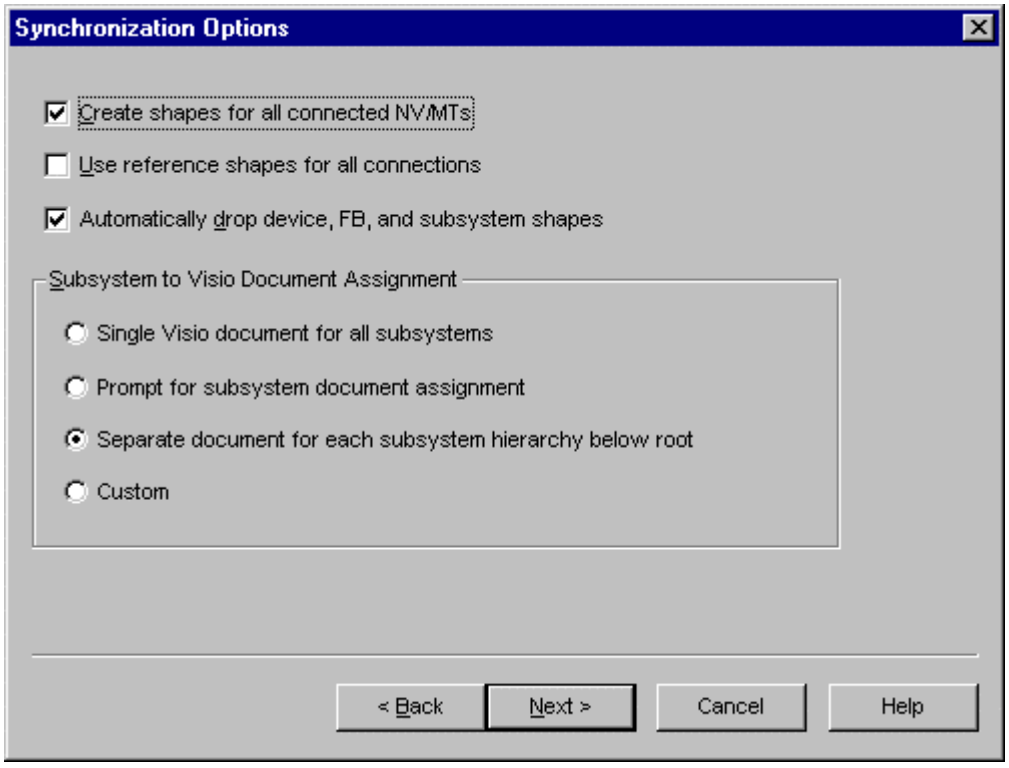
6. If you set **Update Shapes to Current LonMaker Version**, the following window appears.



Choose any combination of the following options:

Shapes	All shapes that have newer versions available than the ones currently in the drawing will be listed. Select the shapes to update.
Items	Set **Menu** to update the shortcut menus for the selected shapes. Set **Appearance** to have the appearance of the shapes updated.

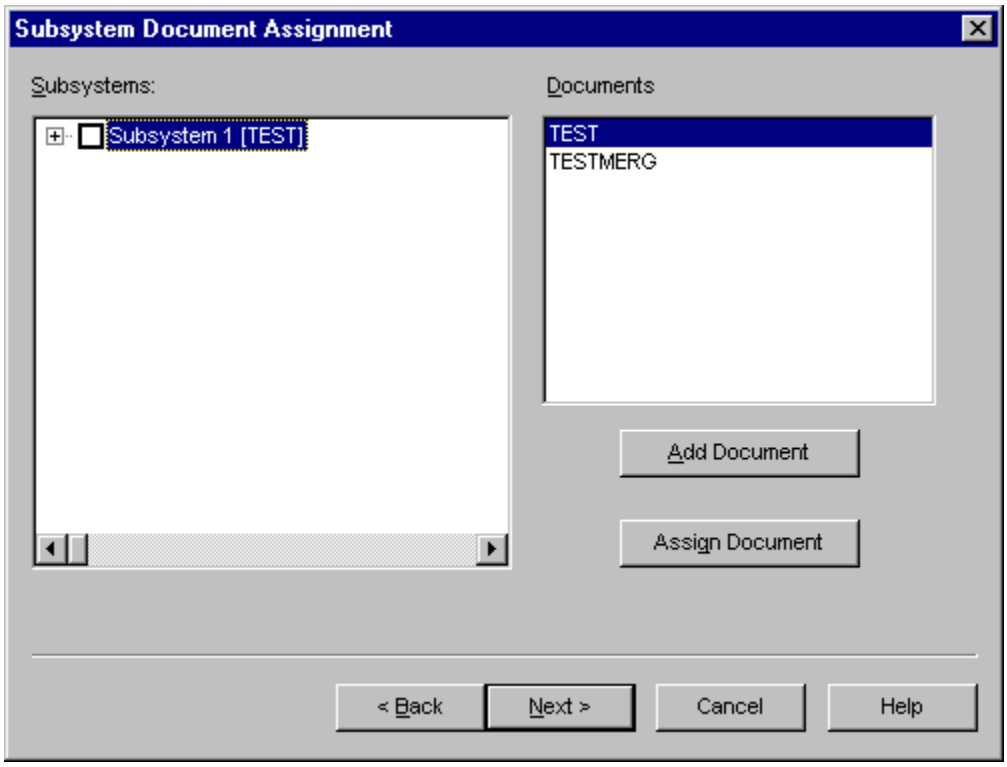
7. If you set **Sync Drawing to Database**, the following window appears.


Synchronization Options
Create shapes for all connected NV/MTs
Use reference shapes for all connections
Automatically drop device, FB, and subsystem shapes
Subsystem to Visio Document Assignment
Single Visio document for all subsystems
Prompt for subsystem document assignment
Separate document for each subsystem hierarchy below root
Custom
< Back
Next >
Cancel
Help

Choose any combination of the following options:

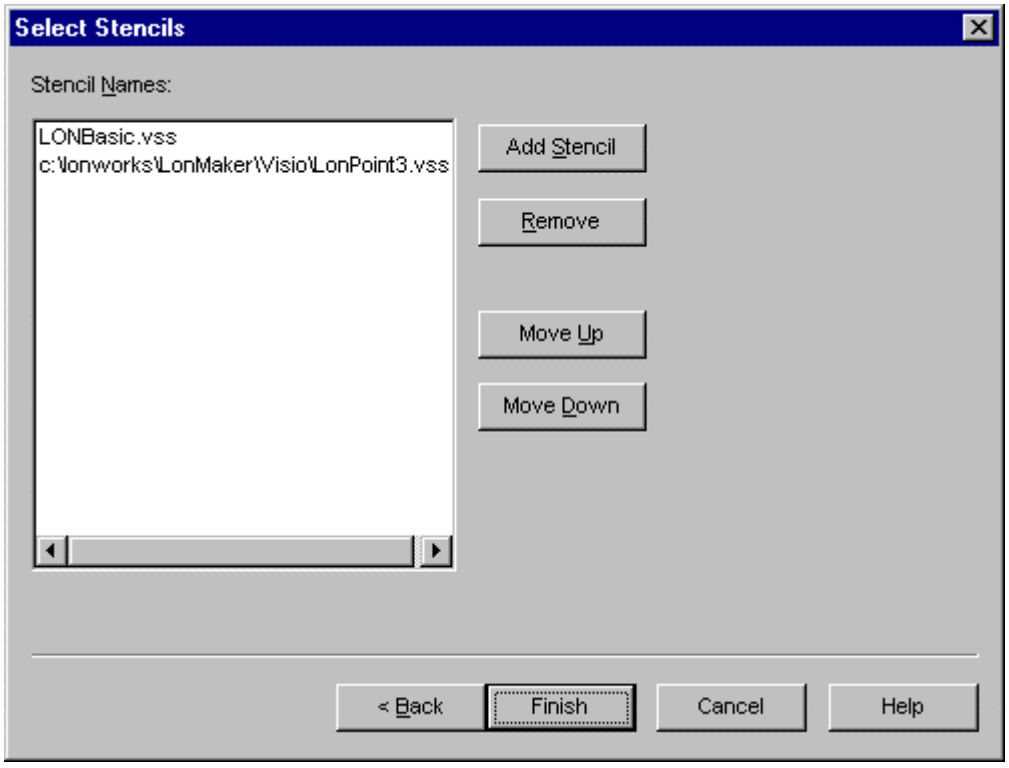
Create Shapes for all connected NV/MTs	Causes shapes to be created in the LonMaker drawing for all connected network variables or message tags.
Use reference shapes for all connections	Causes all new connection shapes to be represented with reference shapes.
Automatically drop device, FB, and subsystem shapes	Causes shapes to be automatically placed within the drawing for all devices, functional blocks, and subsystems. Clear this checkbox to be prompted for each device, functional block, or subsystem shape.
Subsystem to Visio Document Assignment	The following options only apply if a subsystem is found in the LNS network database that was not created by the new LonMaker tool.
Single Visio document for all subsystems	Places all new subsystems in a single Visio document. Use this option for small networks with few subsystems and less than 200 devices.
Prompt for subsystem document assignment	Prompts you to specify the Visio document to which the new subsystems should be assigned.
Separate document for each subsystem hierarchy below root	Places each new subsystem hierarchy below the top-level subsystem in a new Visio document. Use this option for large (greater than 200 devices) or complex networks.
Custom	Displays a dialog that allows you to assign each new subsystem in the network to a Visio drawing file. The dialog allows you to create new drawing files and assign subsystems to the drawing files.

8. Click **Next**. If the `Custom` subsystem assignment checkbox is selected, a window appears that allows you to customize the drawing document assignment of subsystems found by the database resynchronization process.



Subsystems are listed in the left pane, while the Visio drawing documents are listed in the right pane. To assign a subsystem, select the subsystem name, select the desired drawing file, and then click **`Assign Document`**. To add additional drawing files, click **`Add Document`**.

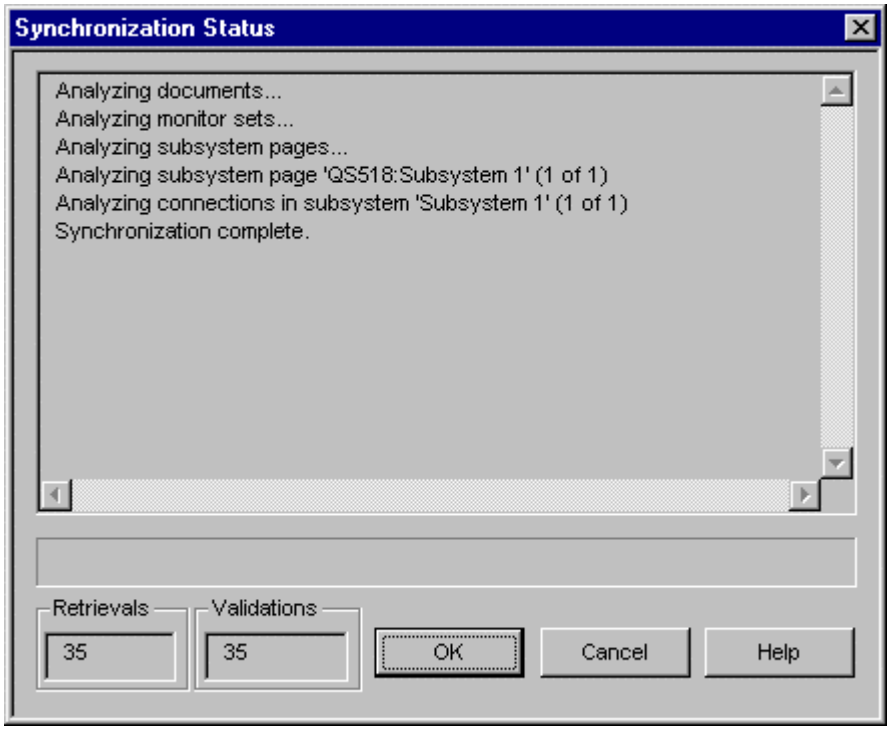
9. If both **Sync Drawing to Database** and **Automatically Drop Device, FB, and Subsystem Shapes** are set, the following window appears:



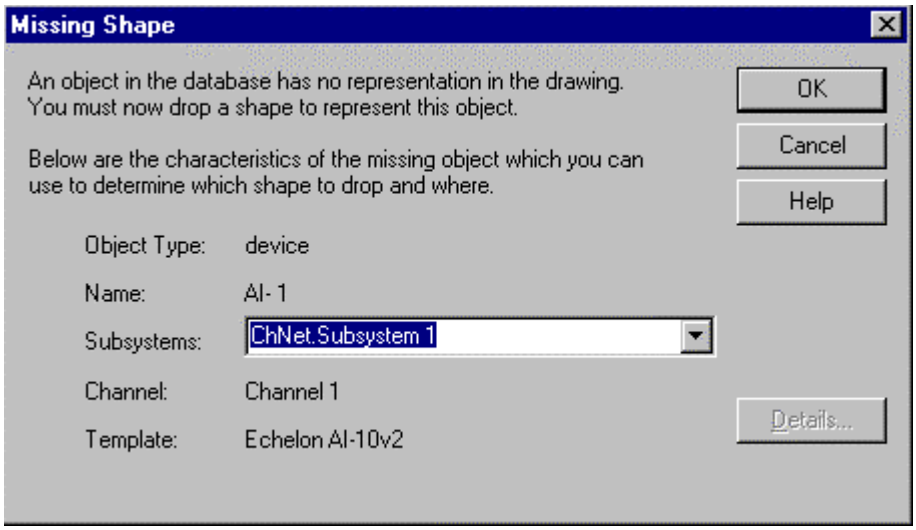
Specify the stencils that you want to be scanned for master shapes. When objects are found within the database that are not already represented in the drawing, the LonMaker tool scans the listed stencils and automatically adds the appropriate shape to the drawing. If the particular master shape for an object is not found, an appropriate generic shape (a LONWORKS Device shape, for example) will be used.

To add additional stencils, click **`Add Stencil`**. To remove a stencil, select the desired stencil, then click **`Remove`**.

10. Click **`Finish`** to begin resynchronization. The following dialog appears, allowing you to monitor the progress of the resynchronization:



11. If the drawing is being resynchronized to match the database, and **Automatically Drop** was cleared, the following dialog appears for each object in the database that is not represented in the drawing:


Missing Shape
An object in the database has no representation in the drawing.
You must now drop a shape to represent this object.
Below are the characteristics of the missing object which you can use to determine which shape to drop and where.
OK
Cancel
Help
Object Type: device
Name: AI-1
Subsystems: ChNet.Subsystem 1
Channel: Channel 1
Template: Echelon AI-10v2
Details...

Click **OK**. The Missing Shape dialog closes and you are returned to the LonMaker drawing.

12. Drag a single shape from a LonMaker stencil to the LonMaker drawing that you want to use for the missing shape. The LonMaker tool will assign the shape to the specified object in the LNS network database. To redisplay the Missing Shape dialog, reselect **Resynchronize** from the **LonMaker** menu.
13. Repeat steps 10 and 11 for each new shape. Once all new shapes have been added and the connections have been updated, synchronization will be complete.

Using LonMaker Styles Overview

The LonMaker tool uses Visio styles to indicate the condition of each *device*, *functional block*, and *connector*.

Using LonMaker Device Styles

Device styles indicate the state of the physical devices and routers in the drawing. The LNS Server monitors the state of devices that have been enabled, and notifies the LonMaker tool of any changes.

The following list describes the device styles:

Style Name	Description
Node Normal	All changes made to the database have been successfully downloaded to the physical device; the device and the database are up-to-date with one another. The default Node Normal style is a solid green fill.
Node Uninstalled	Changes have been made to the database, and the physical device has not been updated. Devices may not be up to date because the LonMaker tool is unattached or is OffNet. Once the device is commissioned and updated, the device style changes to Node Normal. The default Node Uninstalled style is a yellow diagonal fill.
Node Error	Changes have been made in the database, but an error has occurred while updating the device. The device may not be responding properly, a router or channel between the LNS Server and the device may have failed, or a physical connection may be faulty. If the LonMaker tool is OnNet, the LNS Server periodically tries to update the device. Once the device has been updated to match the database, the device style changes to Node Normal. The default Node Error style is a red diagonal fill.
Detached	The LNS Server has detected that the device is not attached or is otherwise unable to communicate with the network. The default Detached style is a red crosshatch fill. If a router becomes detached, the devices on the other side of the router will not show up as detached on the drawing.
State Failure	The LNS Server has detected that the device is not in the expected state. The default State Failure style is a yellow crosshatch fill.

Caution *For Detached and State Failure, devices that have a Ping Interval of* `Never` *are not monitored and will not display these styles.*

Using LonMaker Functional Block Styles

The LonMaker drawing reflects the last known state of the functional blocks. You may update that information in two ways:

- From the **LonMaker** menu, select **Status Summary**. (See *Status Summary* in Chapter 7, *Managing Networks* for more information.)
- Select one or more functional blocks. (See *Device Management* for more information.)

You will see the current state reflected in the LonMaker drawing. The current states are shown and differentiated by the styles. The four styles for a functional block include the following:

Style Name	**Description**
FB SelfTest Fail	Cyan background with red cross-hatching. Used when the FB has reported self-test failure.
FB Disable	Cyan background with yellow cross-hatching. Used when the FB has been disabled.
FB Override	Cyan background with dark blue cross-hatching. Used when the FB has been placed in override mode.
FB Normal	Cyan background. Used when the above styles do not apply.

When multiple states are active concurrently, the style used will be the first that applies based on the order they are listed above.

If multiple states apply and the higher-order state is later cleared, the FB style will be updated to reflect the next applicable state.

Using LonMaker Connector Shape Styles

The following list describes connector shape styles:

Style Name	*Description*
Connector Ack	For acknowledged connections. The connector is a solid line
Connector Unack	For unacknowledged connections. The connector line style is a dash separated by a dot.
Connector Repeated	For unacknowledged repeated connections. The connector line style is dash separated by two dots.

The connection shape text also used the following styles:

Connection Monitor Off	Monitoring disabled. The text is magenta.
Connection Monitor On	Monitoring enabled. The text is black.

LonMaker updates the style of the connectors as required if changes are made to the connections that affect the service type used

Using Network Variable and Message Tag Shape Styles

The following list describes network variable and message tag shape styles:

Style Name	**Description**
Connection Point Normal	The network variable or message tag represented by this shape is not currently exported to a supernode (see *Creating a Supernode*). The default Connection Point Normal style is a solid black fill.
Connection Point Exported	The network variable or message tag represented by this shape is currently exported to one or more supernodes. The default Connection Point Exported style is a solid blue fill.
Configuration Property Normal	The configuration network variable represented by this shape is not currently exported to a supernode (see *Creating a Supernode*). The

	default Connection Point Normal style is a solid black line with a transparent fill.
Configuration Property Exported	The configuration network variable represented by this shape is currently exported to one or more supernodes. The default Connection Point Exported style is a solid blue line with a transparent fill.

Modifying LonMaker Styles

You can change all styles used by the LonMaker tool to modify their representation in a drawing. If the current drawing file styles are modified, only the styles in the drawing file (for that network) will be affected. If the styles are modified in the template (LONWORKS.vst by default), all networks created after the template modification will use the new style.

Merging LonMaker Networks Overview

You can initially install a network as a number of independent sub-networks, each with an independent LNS Server, and later merge the sub-networks into one network. Examples of installations that may use this technique include the following:

Multiple systems	When multiple systems are being installed, the installers for each system want to install and debug their installation without interference from other systems. When each system has been correctly installed, they can be merged into a single network.
Incomplete network fabric	Installation of network portions (floors of a high-rise, for example) may be necessary before connectivity exists for the entire installation site (backbone channel connecting the floors together, for instance). Sometimes, such as a sequential network installation where no permanent server is needed, a portable network server may be used to install each portion as part of the complete network. However, in most cases, it may be easier (if not necessary) to install each portion as a separate network. The sub-networks can then be merged into a single network once the complete network connectivity is in place.

To support these scenarios, the LonMaker tool provides the ability to merge LonMaker networks.

Network Merge Considerations Overview

When creating a new network, consider any future database merges. Design the sub-networks so that the completed network has the most logical configuration. In addition, consider the effect the merge process will have on your network.

The merge process will be disruptive to the operation of both the source and destination networks. For example, devices in the source network will be assigned new subnet/node addresses, connections will be recreated, and authenticated devices will have authentication disabled for a period of time. Devices in the destination network will generally be impacted less, but can be affected if their connections are modified to accommodate the new devices.

Merge Limitations

The database merge process has the following limitations:

Server support only	The database merge does not support merging of networks

	from a remote client (full or lightweight).
Single direction only	There is no provision for backing out a merged database once the process has begun, although you may restore to a previously backed-up database and drawing.
Single root subsystem	The database merge utility only supports networks that have a single root subsystem (which is the default LonMaker drawing option). If the network has more than one root subsystem, the pre-merge utility will fail. You must remove or relocate all but one of the root subsystems, before retrying the pre-merge utility.

Information Loss

When two databases are merged, some information is lost from the source network during the merge process. The following list describes those items:

Non-LonMaker extension records in the LNS database	Only extension records created and maintained by the LonMaker tool are transferred to the destination database.
Registered plug-ins	Plug-ins that are registered in a source database, which are not registered in the destination database, must be re-registered following the merge.
Non-channel object descriptions	The channel description is stored in the channel shape as well as the LNS database. Therefore, these descriptions are transferred to the destination database. Other descriptions are not stored in the shapes and are lost.
Source network addresses, NV selectors, and so on	As part of the merge, all devices in the source network are assigned new addresses on the destination network domain. All connections are reconstructed. Subnet/node IDs, group IDs, NV selectors, and so on probably change. All previously commissioned devices in the source network must be re-commissioned.
Commission Status	None of the devices in the source network are commissioned in the destination network at the completion of the merge. However, their Neuron IDs are preserved and the LonMaker credits necessary to commission them are added.
Network service devices	All network service devices (and their functional blocks and connections) in the source network are removed during the merge.
Unreferenced device templates	Device templates that have been imported but do not have any corresponding devices are not created in the destination network.
Unreferenced connection descriptions	Connection descriptions that have been created but do not have any corresponding connections are not created in the destination network.
User profiles	User profiles in the source network are not created in the destination network.

Merging Two LonMaker Networks

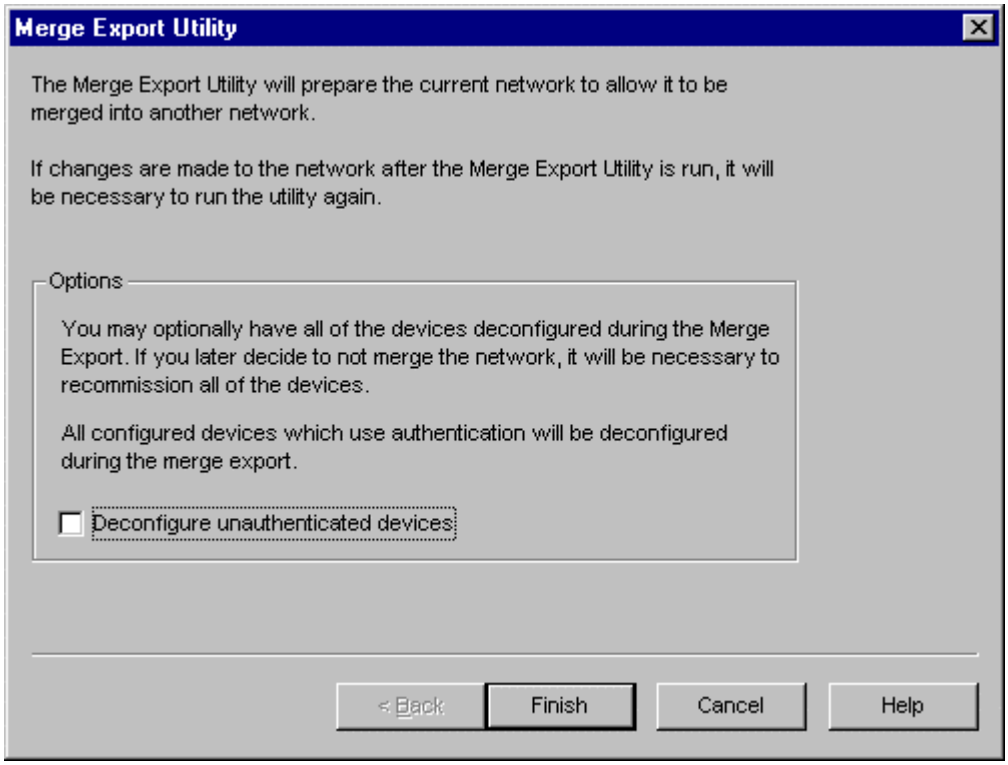
When merging two LonMaker networks, the general procedure is as follows:

- Back up the source database
- Run the pre-merge utility
- Back up the destination database
- Perform the merge

To merge two networks, complete the following steps:

1. Determine the source and destination networks. The source network database and drawing will be added to the destination network database and drawing.
2. Start the LonMaker Design Manager and back-up the source database by selecting the Backup command. The backup is required to restore the network, if the merge process fails for any reason. It will also be used to restore the network, if you later choose not to merge the networks.

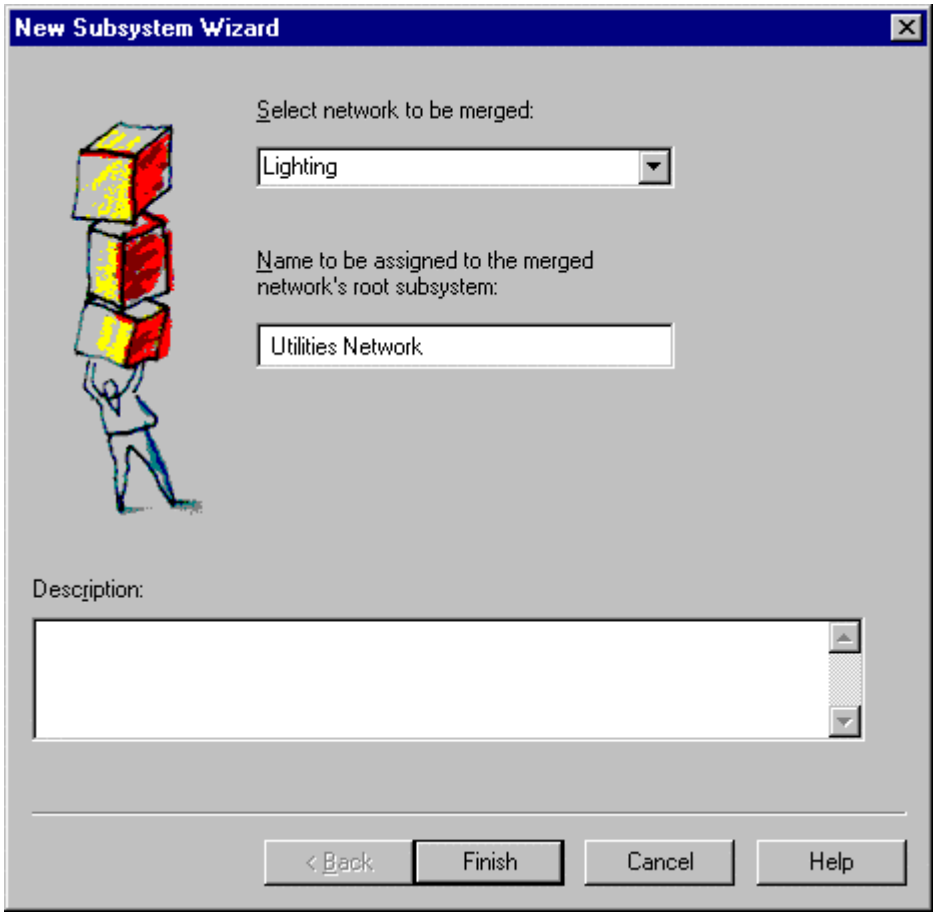
   Note: In this situation, replace the pre-merged network drawing with the backup because the pre-merge utility (steps 4 to 6) adds significant data to the network drawing. This information is not required and will reduce database performance (although there are no other adverse affects).
3. Open the source network.
4. Select the **Database Merge Export Utility** from the LonMaker menu. The following dialog appears:


Merge Export Utility
The Merge Export Utility will prepare the current network to allow it to be merged into another network.
If changes are made to the network after the Merge Export Utility is run, it will be necessary to run the utility again.
Options
You may optionally have all of the devices deconfigured during the Merge Export. If you later decide to not merge the network, it will be necessary to recommission all of the devices.
All configured devices which use authentication will be deconfigured during the merge export.
Deconfigure unauthenticated devices
< Back
Finish
Cancel
Help

5. Select whether to deconfigure unauthenticated devices. (The merge process automatically deconfigures all authenticated devices in the source network.)

6. Click **Finish** to run the pre-merge utility on the source network. This process scans all shapes in the source network and updates their data to correspond to the current values within the LNS database. This process also stores data required for the merge, but which is not normally stored in the object shapes (for example, a device Neuron ID). A status window indicates the progress of the merge export.
7. When the database merge export is complete, exit the LonMaker tool.
8. Open the LonMaker tool, open the destination database, and back up the destination database by selecting the **Backup** command. If a failure occurs during the merge process, the network will be left in a partially merged state and the LonMaker tool will not allow access to the network. To return the network to its original state, you must restore the backup copy of the destination network.

   Ensure that device interface (XIF) files for all devices in the source network are available and in a directory specified in the Network Properties\LonMaker Options\XIF Search Path window.
9. Open the destination network.
10. Merge the source database into the destination database by selecting the Network Merge shape from the LonMaker Basic Stencil and dragging it to the desired subsystem page within the destination drawing. The following dialog appears:



11. Select the source network as the network to be merged from the list. It only contains networks that have been exported using the Merge Export Utility.

12. Specify the name to be used for the merged network's root subsystem.
13. Click **Finish** to begin the network merge. The source network will then be added as a new subsystem (along with its underlying subsystem hierarchy). The merge process copies all documents from the source drawing directory into the destination drawing directory and renames them, as required. The shapes are then scanned and added to the destination network database. A network merge status window appears and indicates the progress of the merge.

    Note: Any errors encountered are shown in the Status window, and are also available in a `Merge_<source network name>.log` file located in the destination-drawing directory.
14. For every unique channel in the source network, the LonMaker tool prompts you to specify whether the same physical channel is already defined in the destination network or is new to the destination network. The Channel Definition dialog is displayed. If the same channel already exists, select its name from the list. If not, specify a name that is unique to the destination network. See *Creating a Channel* in Chapter 4, *Creating Networks* for more information.

7

Managing Networks

This chapter provides information on managing devices, functional blocks, routers, and subsystems.

Managing Networks Overview

You can manage subsystems, devices, functional blocks, and routers. Managing allows you to do the following:

- Test them
- Disable them in order to isolate network problems
- Force functional blocks into the override state to keep parts of the network running while other parts are not functional

The LonMaker tool must be attached to the network (although not necessarily OnNet) to perform management functions.

To manage a device, functional block, router, or subsystem, right-click the shape you wish to manage and then click **Manage** on the shortcut menu. This selection opens the Manage dialog in modeless form. A modeless dialog allows you the advantage of switching out of the dialog to make changes in the LonMaker tool without exiting the dialog. Multiple shapes of different types may be managed simultaneously by selecting multiple device, functional block, router, and subsystem shapes before right-clicking and selecting **Manage**.

The Manage dialog contains the following three tabs:

- *Devices*
- *Functional Blocks*
- *Routers*

See *Managing Devices*, *Managing Functional Blocks*, and *Managing Routers* for specific information on each tab.

When **Manage** is selected for a subsystem, the Manage dialog contains all the devices and routers in that subsystem and its dependent subsystems unless the **Exclude** option is selected.

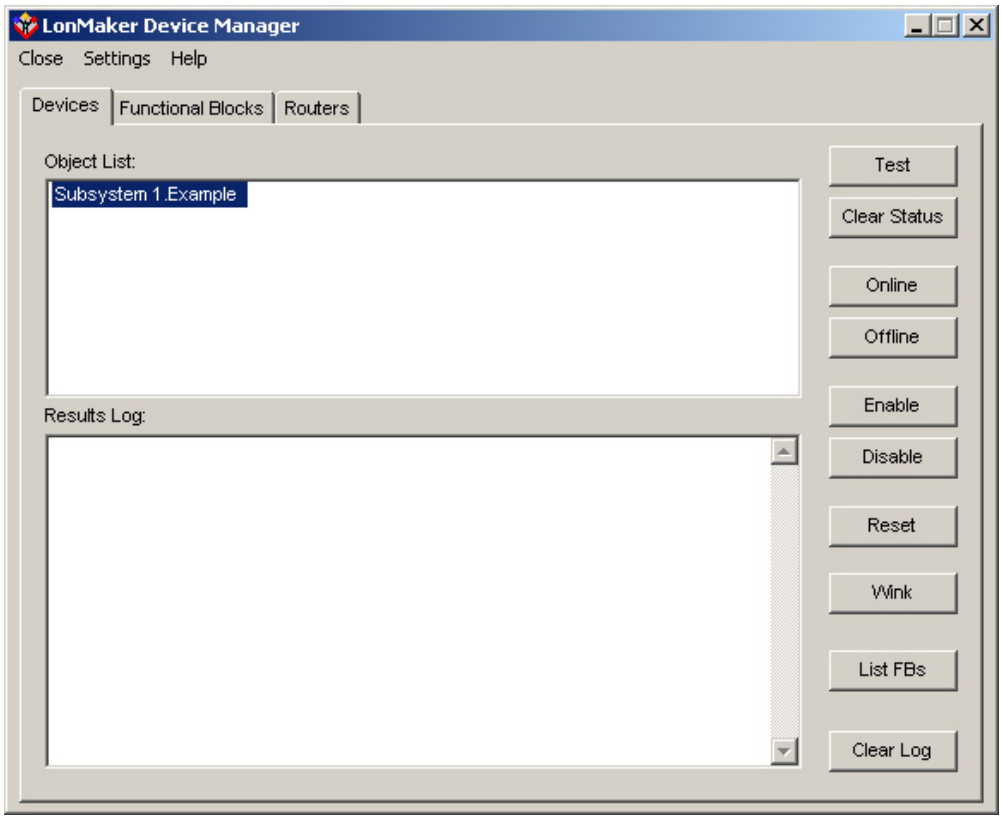
The Manage dialog contains the following three menu items:

- *Close*
- *Settings*
- *Help*

See the *Settings Menu* for information on setting options related to management commands.

Managing Devices

The Devices tab (shown below) of the LonMaker Device Manager window appears after you right-click the shape you wish to manage and then click **Manage** on the shortcut menu.



It contains the following information:

- **Object List** lists all the device shapes you selected to perform a given operation. You may select one, some, or all of the devices to manage.
- **Results Log** lists the results of the management commands. In testing, it also indicates the meaning of a failed test.

Select one or more devices, and click any of the following buttons:

Test — Makes a series of tests to ensure the device is operating and configured correctly. Which tests are made is dependent on the options set in the **Settings** menu item. The results of these tests are displayed in **Results Log**.

Clear Status — Clears the device's network error statistics and the error log. This information is obtained and displayed after issuing a **Test** command.

Online — Puts the device's application in the Online state. The device's application is executing when it is online. If the device was previously in the Online state, this has no effect.

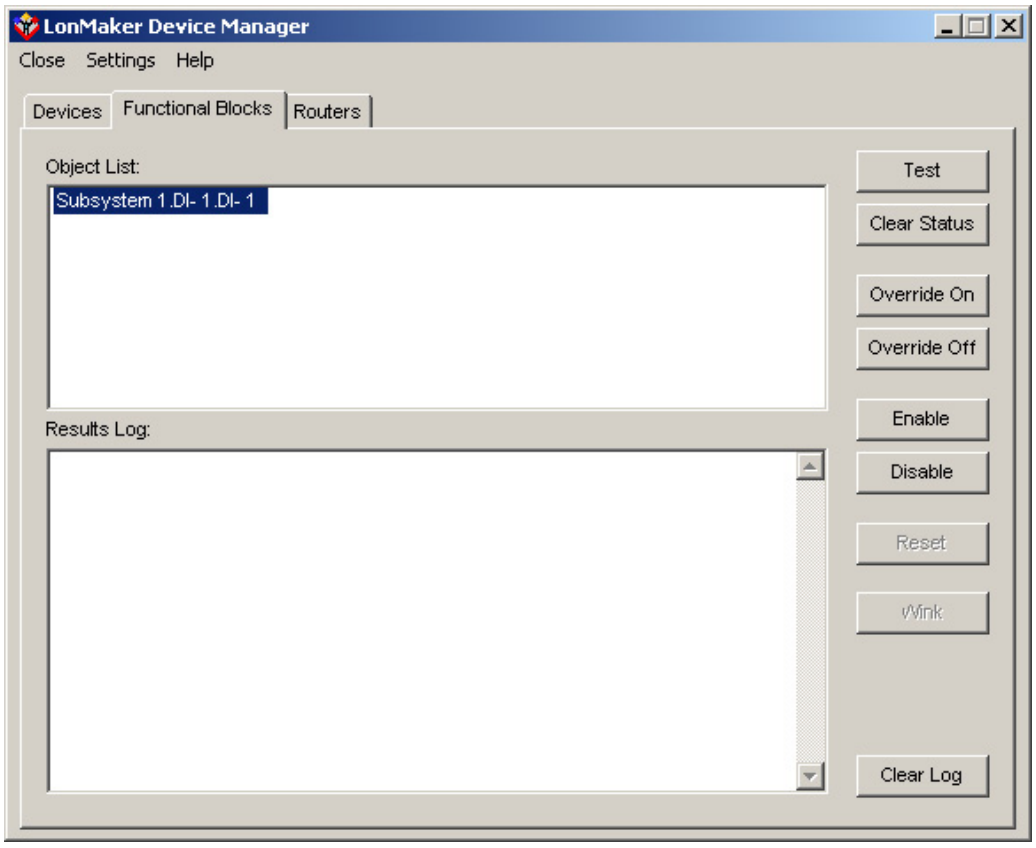
Offline — Puts the device's application in the Offline state. This causes the application to stop running. In this state, the device will still respond to Online, Wink, and Test commands. An Offline device will still receive network variable updates, but the application will not process these values, and the device will not send network variable updates. If the device was previously in the Offline state, selecting this option has no effect. If the device is reset while Offline, it will go Online after the reset.

Enable, Disable	Applies only to devices containing a Node Object. Disabling a device disables all functional blocks on the device. Enabling a device enables all functional blocks on the device. A device must be Online to be Enabled or Disabled.
Reset	Resets the device by sending the `Reset` network management command to the device to stop execution, terminate all incoming and outgoing messages, set all temporary settings to their initial values, and start the application again using the original conditions. If the device was offline, it will be put online.
Wink	Causes the device to generate an application dependant audible or visible response such as flashing a service LED. This command will only have an effect if the device supports the Wink command. This can be useful for identification and testing purposes.
List FBs	Switches the Manage window to the Functional Blocks tab and adds the selected device's functional blocks to the functional block object list.
Clear Log	Clears the **Results Log**.

To close the device manager, select the **Close** menu item. To view *device manager settings*, select the **Settings** menu item.

Managing Functional Blocks

When you invoke the **Manage** command on a functional block, the following Manage dialog appears:



When you choose a functional block to manage, the functional block appears in the Functional Blocks tab of the Manage dialog, and the device containing the functional block appears in the Device tab. The Functional Blocks tab on the Manage dialog contains an **Object List** and a **Results Log**. The **Object List** lists all the functional block shapes you selected to manage. You may select one, some, or all of the functional blocks to perform an operation. The **Results Log** lists the results of the management commands. In the case of testing, it will also indicate the meaning of a failed test.

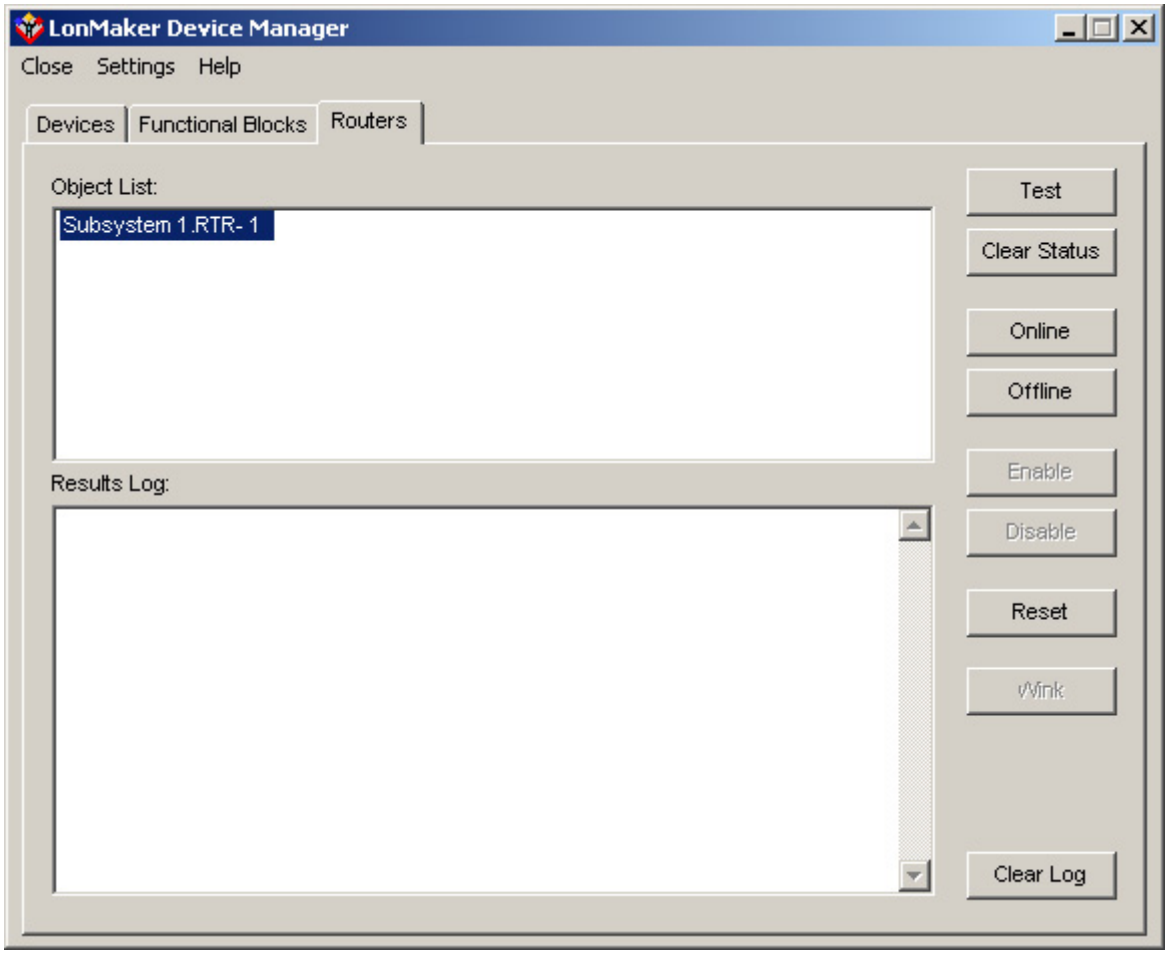
Once you have selected one or more functional blocks, you may click any of the following buttons:

Override On	Puts the functional block into override. The output network variables output their configured override value, even if part of the network is not yet operating and there is no input to the functional block. The override values are set using the functional block's configuration properties. This command requires support for this operation in the device's application. See the documentation for the functional block being managed for more information on how to use override. The device containing the functional block must be Online to use this command.
Override Off	Takes the functional block out of override. The functional block will now function normally. This command requires support for this operation in the device's application. The device containing the functional block must be Online to use this command.
Enable	Activates the functional block. Enabling a previously enabled functional block will have no effect. This command requires support for this operation in the device's application. The device containing the functional block must be Online to use this command.
Disable	Disables the functional block. The functional block will send its configured output network variable defaults. This command requires support for this operation in the device's application. The device containing the functional block must be Online to use this command.
Wink, Reset	Not applicable to functional blocks.
Test	Makes a series of tests to ensure the functional block is operating correctly. Which tests are made is dependent on the options set in the Settings tab. The results of these tests are displayed in the Results Log field. This command requires support for this operation in the device's application.
Clear Status	Clears the Node Object test flags for the selected functional block. The state of the functional block is not changed. This command requires support for this operation in the device's application. The device containing the functional block must be Online to use this command.
Clear Log	Clears the Results Log.

To close the device manager, select the **Close** menu item. To view *device manager settings*, select the **Settings** menu item.

Managing Routers

When you invoke the Manage command on a router, the following Manage window appears:



The Routers tab on the Manage dialog box contains an **Object List** and a **Results Log**. The **Object List** lists all the router shapes you selected to perform an operation. You may select one, some, or all of the routers to manage. The **Results Log** lists the results of the management commands. In the case of testing, it will also indicate the meaning of a failed test.

When you have selected one or more routers, you may click any of the following buttons:

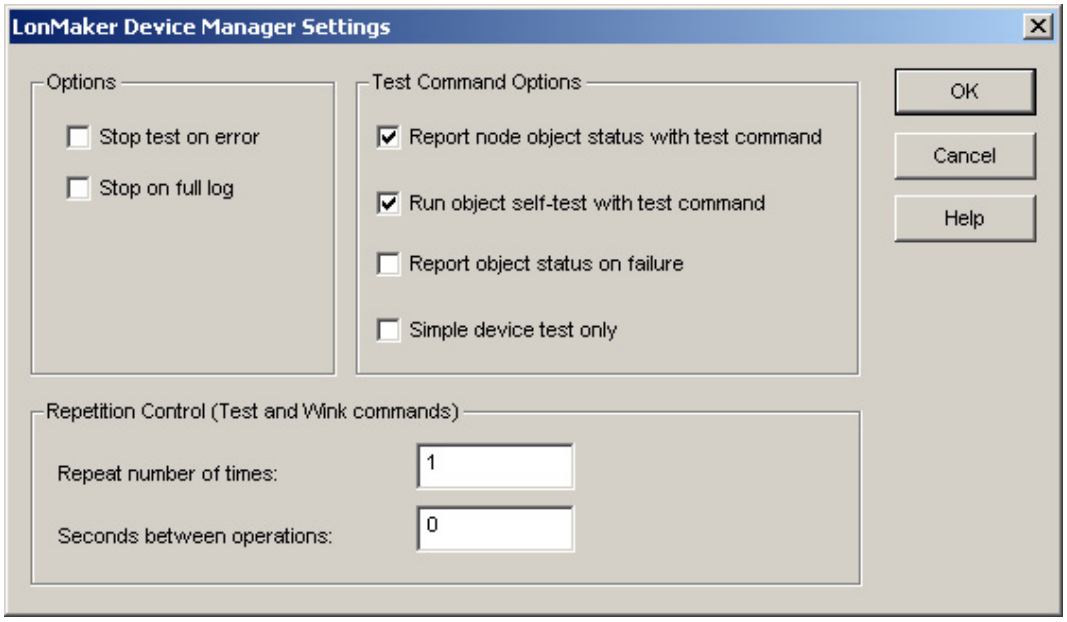
Online	Puts the router's application in the Online state. This allows the router to forward packets between its two channels. If the router was previously in the Online state, this has no effect.
Offline	Puts the router's application in the Offline state. This causes the router to stop forwarding packets. If the router was previously in the Offline state, this has no effect. If a router is reset while Offline, the router will be placed Online after the reset.
Enable, Disable, Wink	Not applicable to routers.
Reset	Resets the router by sending the Reset network management command to both sides of the router to stop execution, stop all packet forwarding, set all temporary settings to their initial values, and restart the router application. If a router is reset while Offline, the router will be placed Online after the reset.

Test	Makes a series of tests to ensure the router is configured and operating correctly. Which tests are made is dependent on the options set in the Settings tab. The results of these tests are displayed in the Results Log window.
Clear Status	Clears the network error statistics for both sides of the router.
Clear Log	Clears the Results Log.

To close the device manager, select the **Close** menu item. To view *device manager settings*, select the **Settings** menu item.

Device Manager Settings

The Settings dialog of the Device Manager appears as follows:



This dialog allows you to set options for the Device Manager window. These options are related to device, router, and functional block management. Click **OK** to make the indicated changes effective. Use this dialog to set the following options:

Options

Stop Test on Error	Stops test immediately if an error is reported in any of the tests it runs.
Stop on Full Log	Stops immediately if the results log becomes full. The Test command will not execute again until you click **Clear Log**.

Test Command Options

Report Node Object Status with Test Command	Displays the status of the Node Object for the device being tested in the results log of the Device tab's Test command. This option only applies to those devices that contain a compatible Node Object functional block.
Run Object Self-Test with Test Command	Sends a self-test command to the object being tested and displays the results of the self-test in the results log. If cleared,

	no self-test will be sent as part of the testing procedure.
Report object status on failure	Reports an object's status in the Results Log when it fails a management command.
Simple Device Test	Limits the device test to a simple Query Status command. This selection reduces the amount of network traffic generated by the Test command, and may be useful when communications are performed over low-bandwidth channels.
Repetition Control	
Repeat Number of Times	Specifies how many times a Wink or Test command will be repeated. The default is 1. You can set this option to have Wink or Test commands repeated.
Wait Between Operations	Specifies how long to wait between repeating a Wink or Test command when the Repeat Number of Times option is set to be greater than 1.

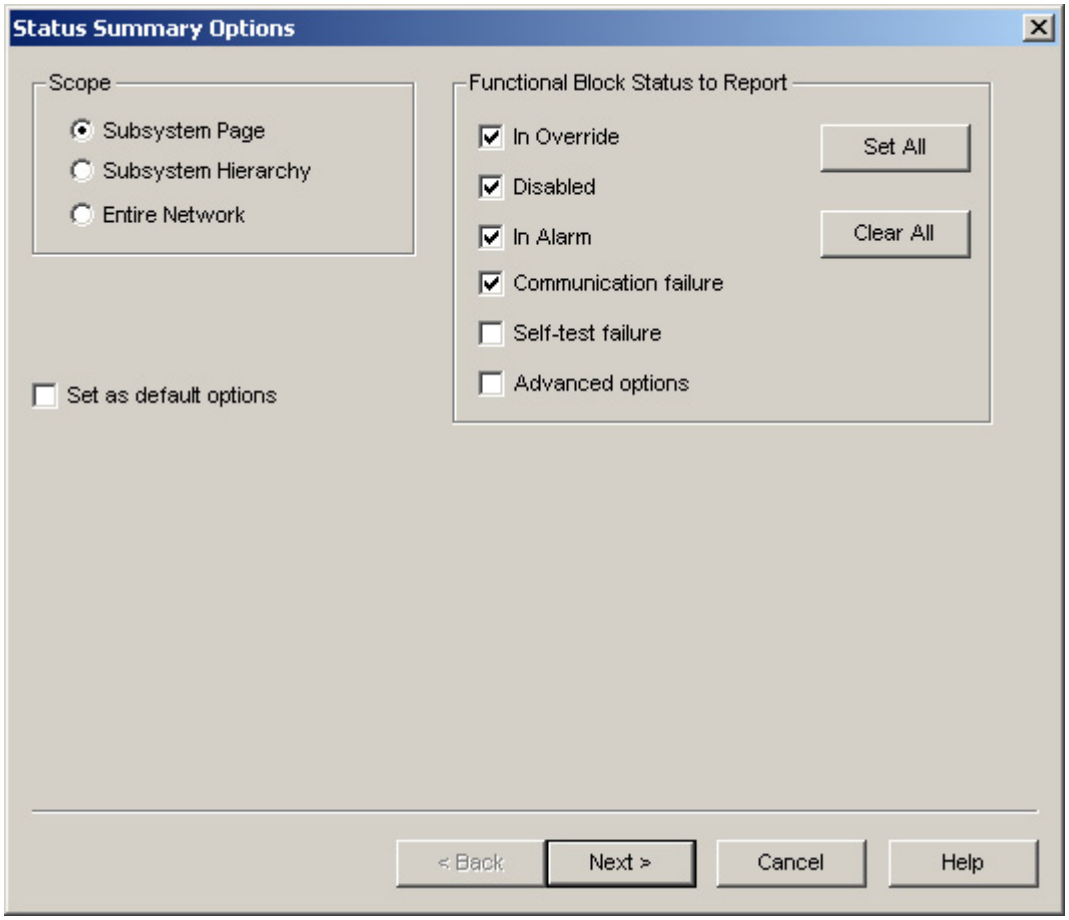
Status Summary

You can generate a status summary report to see a detailed listing of functional blocks that are in override, alarm, and disabled states as selected by the user, and routers and devices that are not configured and online.

Individual devices, functional blocks, and routers may be tested using *the management commands*.

To generate a status summary report, follow these steps:

1. Select **Status Summary** from the **LonMaker** menu. The *Status Summary Options* dialog appears.



For more information on the individual items, refer to specific hardware manuals or LONMARK documentation.

2. Set the following options:

Scope

Determines which devices, routers, and functional blocks are contained in the status summary.

- Subsystem Page summarizes the shapes in the current subsystem page
- Subsystem Hierarchy summarizes the shapes in this subsystem and all subsystems contained in it (including nested subsystems)
- Entire Network summarizes all the shapes in the network.

Functional Block Status to report

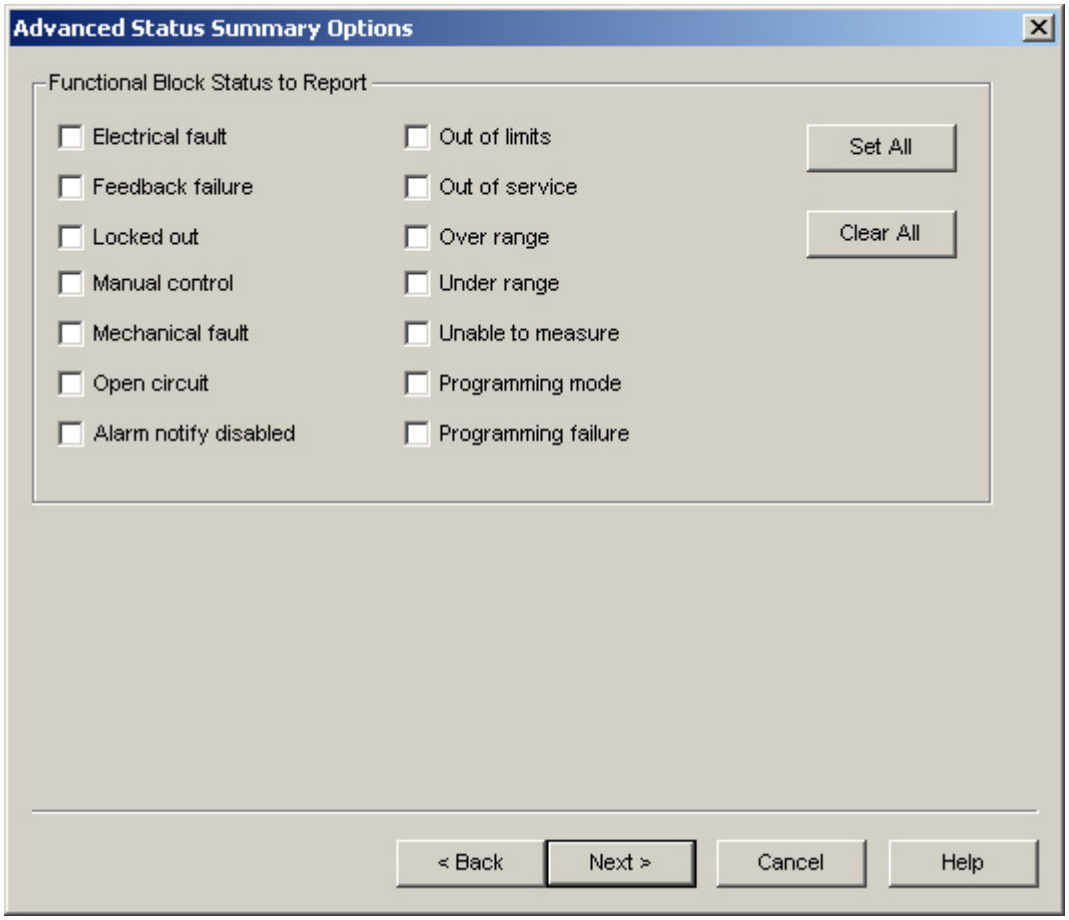
Determines what information about functional blocks will be summarized.

Select any combination of options to display information about which blocks are in the override condition, disabled, in alarm, and have had communication and self-test failures.

Set **Advanced Options** to open a dialog containing

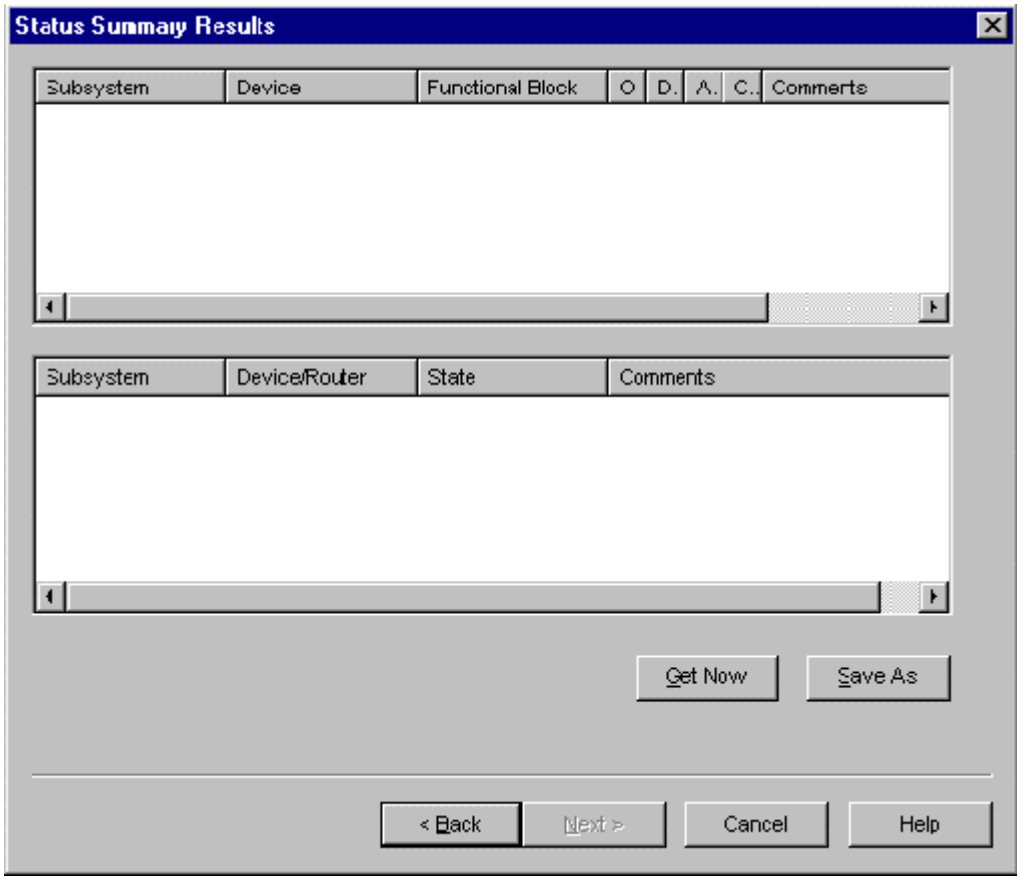
	additional status summary options when you click **Next**. Not all functional blocks report on all the status conditions. If a functional block does not report on a given status, the LonMaker tool treats it as if status was reported as not set by the device.
Set as default options	Sets the options selected in this dialog to become the defaults for this LonMaker network. The default options are set when you click **Next**.

3. Click **Next**. If the **Advanced Options** was set, the Advanced Options dialog opens.



Select additional status items to report. For more information on the items themselves, refer to hardware manuals or LONMARK documentation.

4. Click **Next**. The following Status Summary Results dialog appears:



5. Click **Get Now** to show the status summary for the routers, devices, and functional blocks within the scope configured on the previous window. A one-line summary displays next to the **Get Now** button stating the number of devices and routers included in the summary. The window shows the following information:

Functional Blocks	Lists functional blocks in which any of the selected state bits are set, or an error in the attempt to read the status. Each row of this list contains a summary of one functional block. This lists the name of the functional block, the set state bits, and any comments about the functional block.
Devices/Routers	Lists devices and routers that are not configured and online. (If a device is not configured and online, the status of its functional blocks is not available.) Each row of this list contains a summary of one device or router. This lists the name of the device or router, the state of the device or router, and any comments.

6. To save the information to a comma-delimited text file (.txt extension), click **Save As**.

Introducing the LNS Report Generator

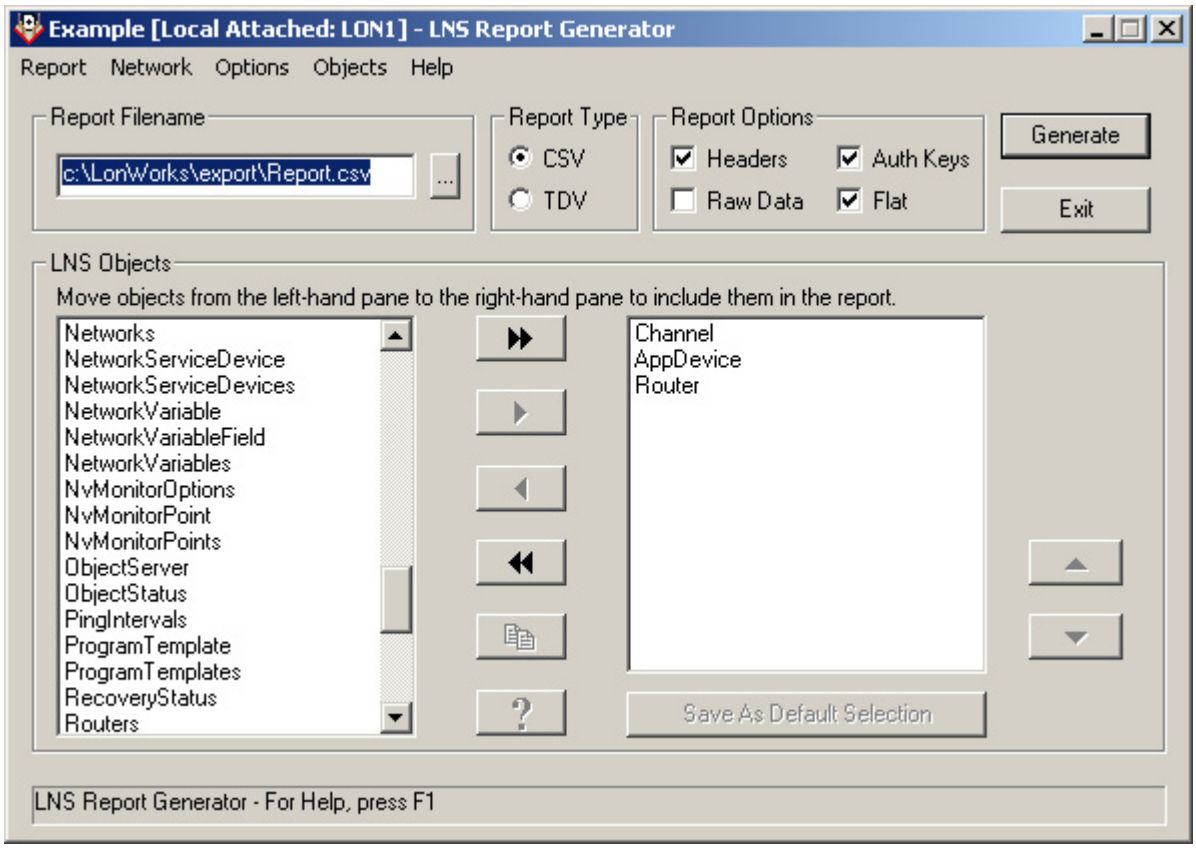
LNS Report Generator is an *LNS plug-in* that generates customized reports for a LONWORKS network. You can start it as a standalone application or from the LonMaker tool. The LNS Report Generator works both as a local and a remote application.

Generating a Report

To generate a report for a LONWORKS network from the LonMaker tool, follow these steps:

If you have not registered the *LNS Report Generator* plug-in for this network, *register it* now.

1. Open the **LonMaker** menu and select **System Plug-Ins**.
2. Select the **Generate Echelon LNS Report** command. The following LNS Report Generator dialog opens:



3. Select CSV (Comma Delimited Values) or TSV (Tab Delimited Values) in **Report Type** to determine the format of the report.
4. Enter the report file name in **Report Filename**.
5. Select the desired report options in **Report Options**. The following options are available:

   Headers — When selected, a header record will be output before each new block of property data. This header record will contain the name of each property along with the units of that property. (In Excel this header block can be used as a data filter selector). When not selected, there will be no inter-block headers or gaps. There will always be a partial header at the top of the report (in Excel, this allows you to more easily

filter the report data).

Raw Data — When selected, property values will be output in raw format. No symbolic constants will be displayed. When not selected, further processing will be performed on the property values, depending on their type. Typically symbolic constants will replace constant values.

Auth Keys — When selected, authentication keys will be displayed in the report. When not selected, authentication keys will be hidden in the report to provide security.

Flat — When selected, a flat report will be generated. This will group similar objects together in the order specified under LNS Object Selection. When not selected, a hierarchical report will be generated. Objects will be grouped near their parent objects in a hierarchical arrangement.

6. Select the objects of interest by moving them to the right-hand list under LNS Objects.
7. You can get information about any object by choosing the object and then selecting **Object Help** from the **Objects** menu, or by pressing the **?** button.
8. Reorder the selected LNS objects in the right-hand list by selecting **Move Up** or **Move Down** from the **Objects** menu or by pressing the appropriate button. The order shown is the order that objects will appear in the final report; the Hierarchical Report (**Flat** cleared) partially overrides this ordering.
9. Click **Generate** to start report generation.
10. To generate additional reports, repeat the above steps with different report options and file name.
11. Click **Exit** to quit.

The procedure described above creates a comma or tab delimited text file with a report of the selected object. You can import this file into a spreadsheet or database application to reformat and print the report.

For more information on using the LNS Report Generator, see the *LNS Report Generator* topic in the *LNS Utilities and LONMARK Reference* help file.

8

LonMaker Credits

This chapter provides information on licensing; using, viewing, and adding LonMaker credits; and transferring a LonMaker license.

Licensing with the LonMaker Tool

Your licensed copy of the LonMaker software includes 64 (for LonMaker Professional Edition) or 5 (for LonMaker Standard Edition) free *LonMaker credits*. A LonMaker credit is a token representing a prepaid fee to commission a device. You can use LonMaker credits to commission devices in one network or in multiple networks. LonMaker credits are associated with the LonMaker application and the computer running it and are stored in a file called the *LonMaker license file*. The LonMaker tool keeps track of the number of credits you have available. You can use the LonMaker tool to commission devices even if you have a credit deficit, but only for two weeks. See *Using Deficit Credits* for more information.

Caution *Certain after-market disk defragmenters such as Symantec's Norton Utilities Speed Disk or Executive Software's Diskeeper can break the LonMaker license if the disk defragmentation software is not configured properly. Other disk utilities that bypass the operating system's file system can also break the license. The disk defragmenters built into Windows XP, Windows 2000, and Windows 98 do not break the license. Prior to defragmenting your disk using an after-market disk defragmenter, configure it not to move files with .ent, .key, or .rst extensions. How this is done is dependent upon the after-market disk defragmenter that you are using. For example, if you are using the Norton Speed Disk utility on the computer running the LonMaker tool, you must set the following option or you will lose your LonMaker license file: start Speed Disk, open the* File *menu, select the* Options > Customize > Unmovable Files *command, and specify *.ent, *.key, and *.rst. Then open the* File *menu and select the* Options > Optimization > Save *command to save the change. If the after-market disk defragmentation program that you are using is not configurable, either use the disk defragmentation built into Windows, or use after-market disk defragmentation software that is configurable.*

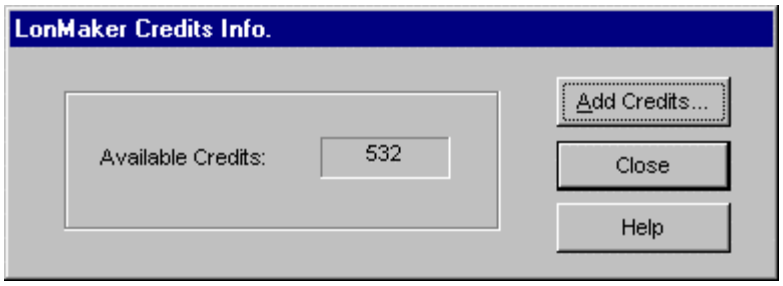
Caution UPGRADING FROM WINDOWS 95 TO WINDOWS 98 CAN CAUSE YOUR LONMAKER LICENSE FILE TO BE DELETED. *Once this happens, you cannot use the LonMaker tool until you get a replacement key from Echelon. This happens if the partition on which Windows is installed is converted from FAT to FAT32. If you plan on upgrading to Windows 98 and converting your boot partition from a FAT to FAT32 file system, transfer the license to another computer as described in Transferring a LonMaker License before upgrading. When the upgrade has been completed, transfer the license back again.*

Using LonMaker Credits

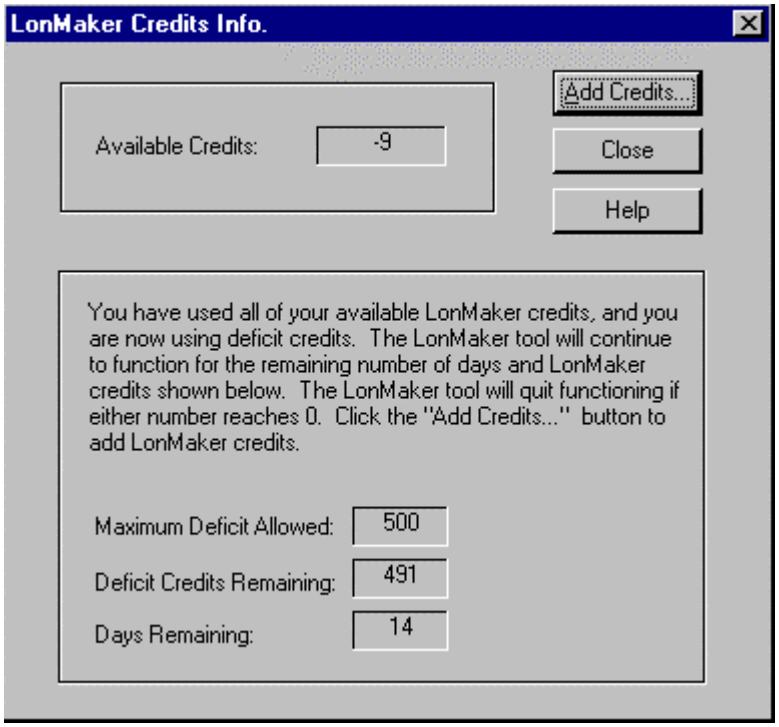
Each time you use the LonMaker tool to commission a device while OnNet, one LonMaker credit is used. No credits are used when you commission routers, network service devices, or the LNS Server device. The LonMaker tool uses no additional credits for replacing devices that have been commissioned by the LonMaker tool or recommissioning devices that are already in the database even if you change the application or program IDs in the devices. No LonMaker credits are used while you design a network using the engineered system installation scenario; they are deducted when you commission the physical devices. You will get LonMaker credits back for deleting devices commissioned with the LonMaker tool, up to a maximum of the number of devices you have commissioned or 32,767, whichever is less.

Viewing LonMaker Credits

You can view the number of LonMaker credits you have left on your computer. Open the **LonMaker** menu and select **LonMaker Credits Info**. The following window appears.



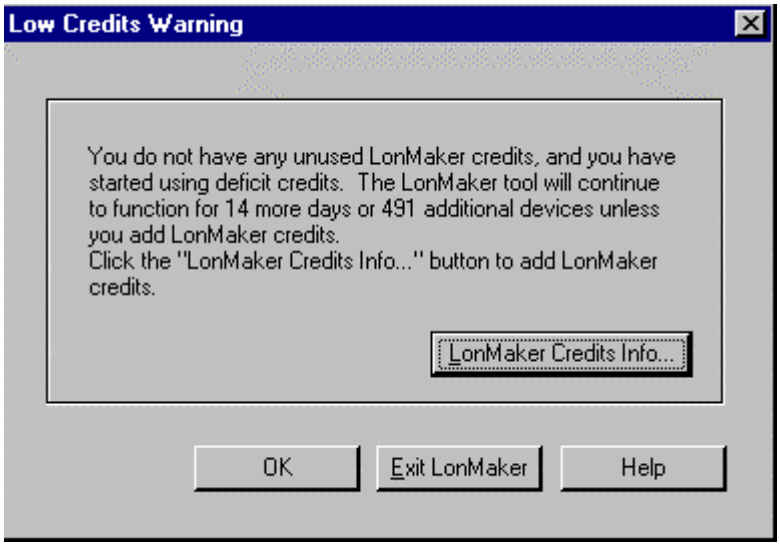
If you have used all of your available LonMaker credits and you are now using deficit credits, the LonMaker Credits Info dialog displays additional information about your deficit credit status:


LonMaker Credits Info.
Available Credits:
-9
Add Credits...
Close
Help
You have used all of your available LonMaker credits, and you are now using deficit credits. The LonMaker tool will continue to function for the remaining number of days and LonMaker credits shown below. The LonMaker tool will quit functioning if either number reaches 0. Click the "Add Credits..." button to add LonMaker credits.
Maximum Deficit Allowed:
500
Deficit Credits Remaining:
491
Days Remaining:
14

Once you have viewed your LonMaker credit information, you can add LonMaker credits. See *Adding LonMaker Credits* for instructions.

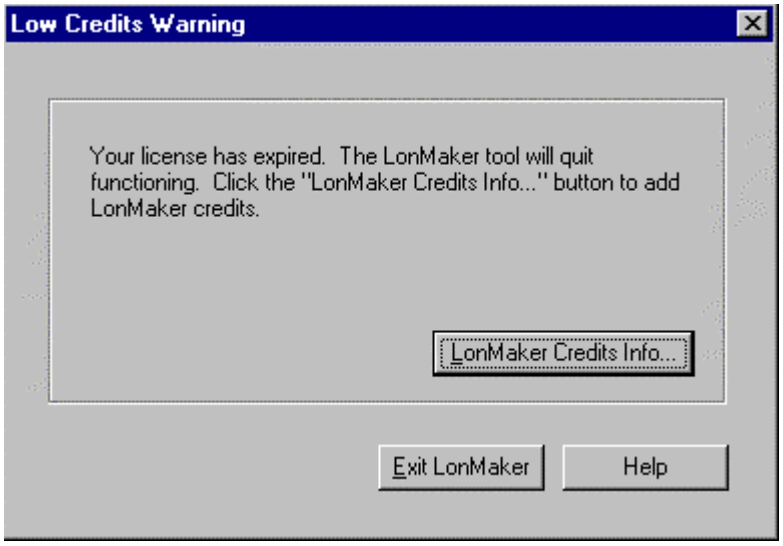
Using Deficit Credits

If you use all of your LonMaker credits and you want to commission additional devices, the LonMaker tool will continue to function and you will be able to continue commissioning devices for up to two weeks or 500 additional commissioned devices (deficit credits), whichever comes first. This gives you time to purchase additional credits. During the two-week period, each time a network is opened or created, after every hour of use, each time you switch to a different drawing page, and every time you commission a new device, the LonMaker tool displays a dialog indicating the status of your deficit credit use.


Low Credits Warning
You do not have any unused LonMaker credits, and you have started using deficit credits. The LonMaker tool will continue to function for 14 more days or 491 additional devices unless you add LonMaker credits.
Click the "LonMaker Credits Info..." button to add LonMaker credits.
LonMaker Credits Info...
OK
Exit LonMaker
Help

The dialog displays the number of days and credits remaining. This value changes to accurately reflect the state of your license. If you want to continue running the LonMaker tool once you have begun using deficit credits, you must purchase enough LonMaker credits to cover all deficit credits.

If you do not purchase valid credits in time, the LonMaker tool becomes disabled and the following dialog is displayed:


Low Credits Warning
Your license has expired. The LonMaker tool will quit functioning. Click the "LonMaker Credits Info..." button to add LonMaker credits.
LonMaker Credits Info...
Exit LonMaker
Help

Licensing Remote Clients

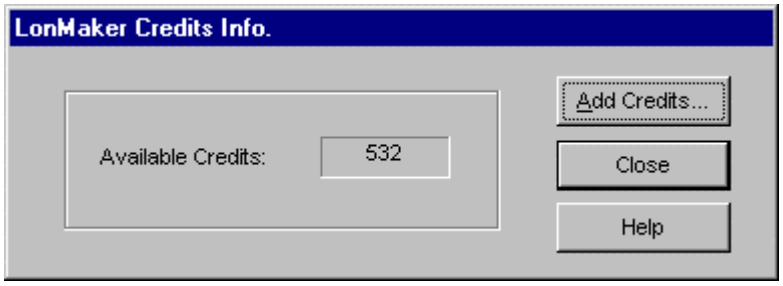
The LonMaker tool can be used on a computer that is remote from the LNS Server, called a *remote client*. (See *Using the LonMaker Tool Remotely*.) You can run the LonMaker tool on multiple remote client computers. You must purchase a valid license for each remote client.

Once licensed, a remote computer has its own pool of LonMaker credits. This allows multiple integrators to install and commission devices on the same network from different computers on the network. In this case, each integrator would manage the credits on their remote computer.

See *Adding LonMaker Credits* for information on obtaining additional LonMaker licenses.

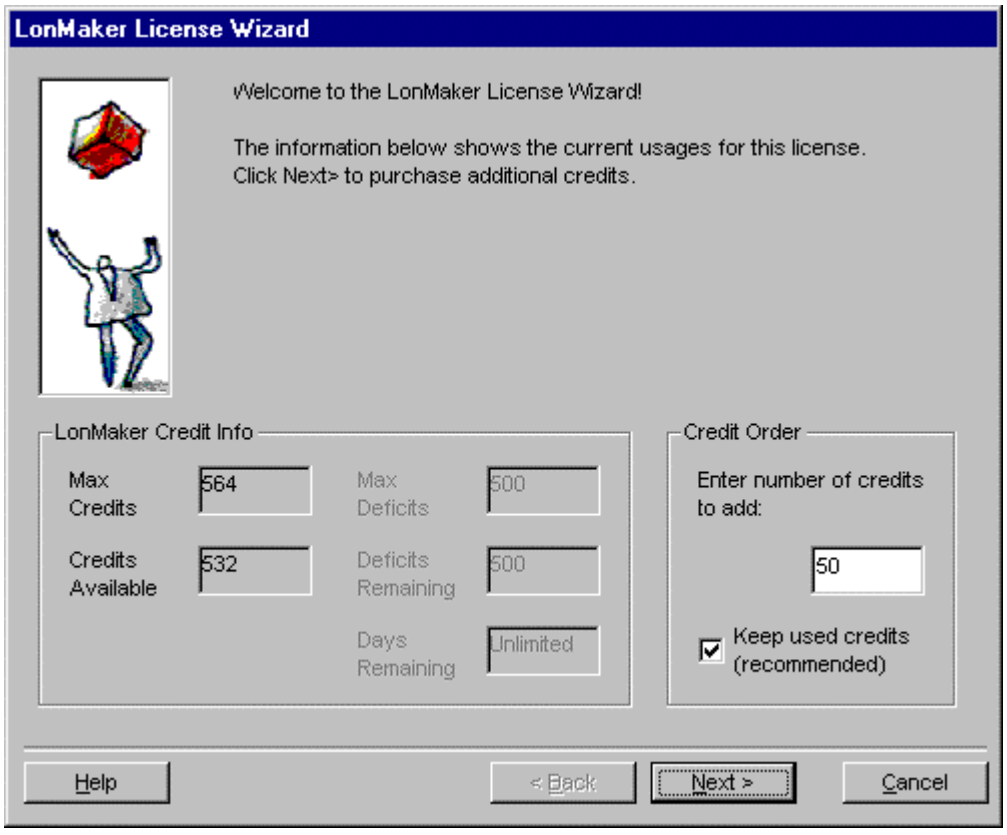
Adding LonMaker Credits

If you want to commission more devices then the number of credits that shipped with your edition of the LonMaker tool (i.e. 64 for the Professional Edition or 5 for the Standard Edition), you need to purchase additional LonMaker credits from Echelon or other authorized LonMaker credit reseller. You cannot purchase additional credits for the Trial Edition. Free LonMaker credits are available for development, test, support, replacement, or training use. To order LonMaker credits, click the **LonMaker** menu and select **LonMaker Credits Info**. The following window appears.



To order additional LonMaker credits, follow these steps:

1. Click **Add Credits** to access the *LonMaker License Wizard*.

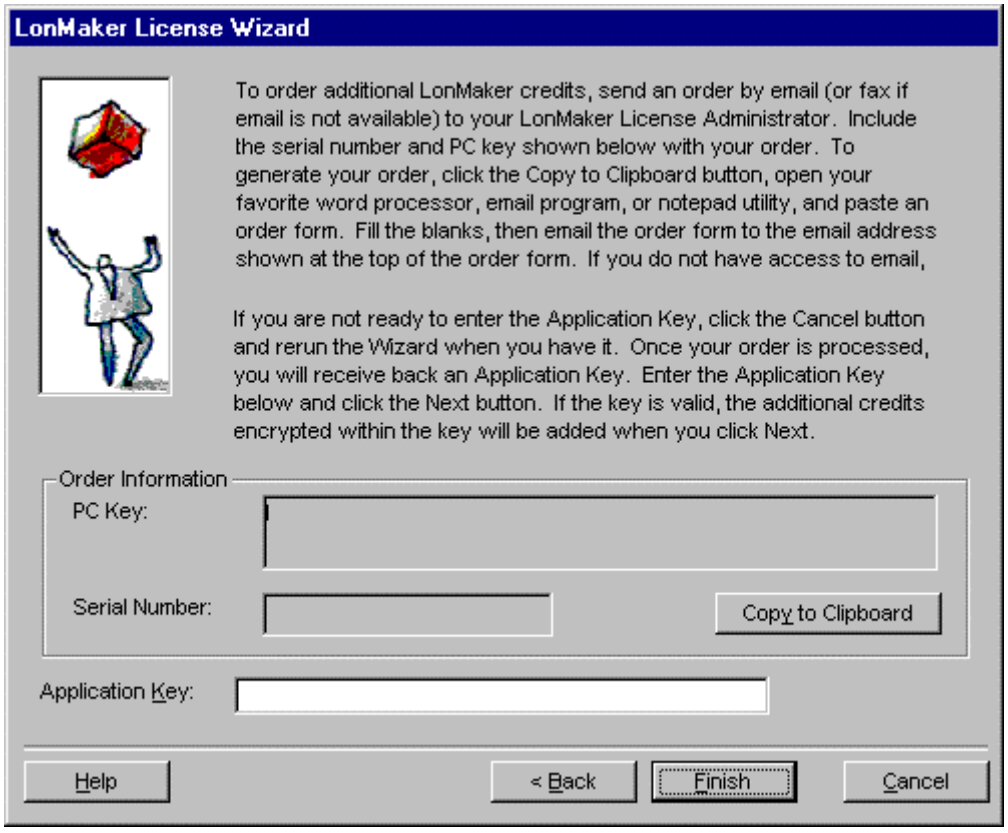


This window displays your maximum and available credits, as well as the status of the deficit you are running if you are using more than your maximum.

2. Enter the number of additional credits you would like to add. Set **Keep Used Credits** to allow credits that are currently being used to be returned in the future. For example, you have 100 credits, 10 of which are used, and you want to add 50 more. If this option is selected, you will have 150 credits, 10 of which are used, once the purchase is complete. If this option is not selected, you will have 140 credits, none of which are used, once the purchase is complete. You must purchase a minimum of 20 credits.

   Used credits are returned when you delete commissioned devices. In the first scenario above, if you deleted 10 commissioned devices, you would have 150 credits. In the second scenario, if you deleted 10 commissioned devices, you would still have 140 credits.

3. Click **Next**. The wizard displays your LonMaker serial number and a 66 digit PC Key that uniquely identifies your copy of the LonMaker tool and the computer running the LonMaker tool.


LonMaker License Wizard
To order additional LonMaker credits, send an order by email (or fax if email is not available) to your LonMaker License Administrator. Include the serial number and PC key shown below with your order. To generate your order, click the Copy to Clipboard button, open your favorite word processor, email program, or notepad utility, and paste an order form. Fill the blanks, then email the order form to the email address shown at the top of the order form. If you do not have access to email,
If you are not ready to enter the Application Key, click the Cancel button and rerun the Wizard when you have it. Once your order is processed, you will receive back an Application Key. Enter the Application Key below and click the Next button. If the key is valid, the additional credits encrypted within the key will be added when you click Next.
Order Information
PC Key:
Serial Number:
Copy to Clipboard
Application Key:
Help
< Back
Finish
Cancel

4. Click **Copy to Clipboard**.

5. Open a word processor application, an email application, or a notepad utility and paste the contents of the clipboard into a new document. Paste the entire form and do not delete parts of it. Incomplete forms can delay your LonMaker credit order.

6. Fill in the blanks on the form. To order free credits, check the reason that you are ordering free credits after verifying that you comply with the terms of your selected choice. Email the form to the address at the top of the form. If you do not have access to email, print the form and fax it to the fax number at the top of the form. Upon receiving your form, Echelon will provide you with an application key that increases the number of LonMaker credits for the

specified computer. You cannot use this key with the LonMaker tool installed on another computer, and you cannot reuse the key on the same computer for additional credits.

Caution	*Until you receive your application key, do not delete any devices that are commissioned, decommission any devices, or merge networks. These actions invalidate your PC Key and require the generation of a new key. You may add new devices, commission devices, or delete devices that are not currently commissioned. You can do any other actions that do not result in deleting or decommissioning commissioned devices such as configuring devices or working with connections.*

7. Install the application key in the `Application Key` field and click **Next**. A window appears confirming that you have successfully added LonMaker credits to your license. Click **Finish**, and restart the LonMaker tool to enable your new LonMaker credits.

If you do not have access to email or a printer, make a copy of the order form in the back of the *LonMaker for Windows User's Guide*, fill in the appropriate information, and fax the form to the fax number on the form.

Note: If you run the License Wizard again after successfully entering and using an application key, the License Wizard will generate a new PC Key.

Transferring a LonMaker License

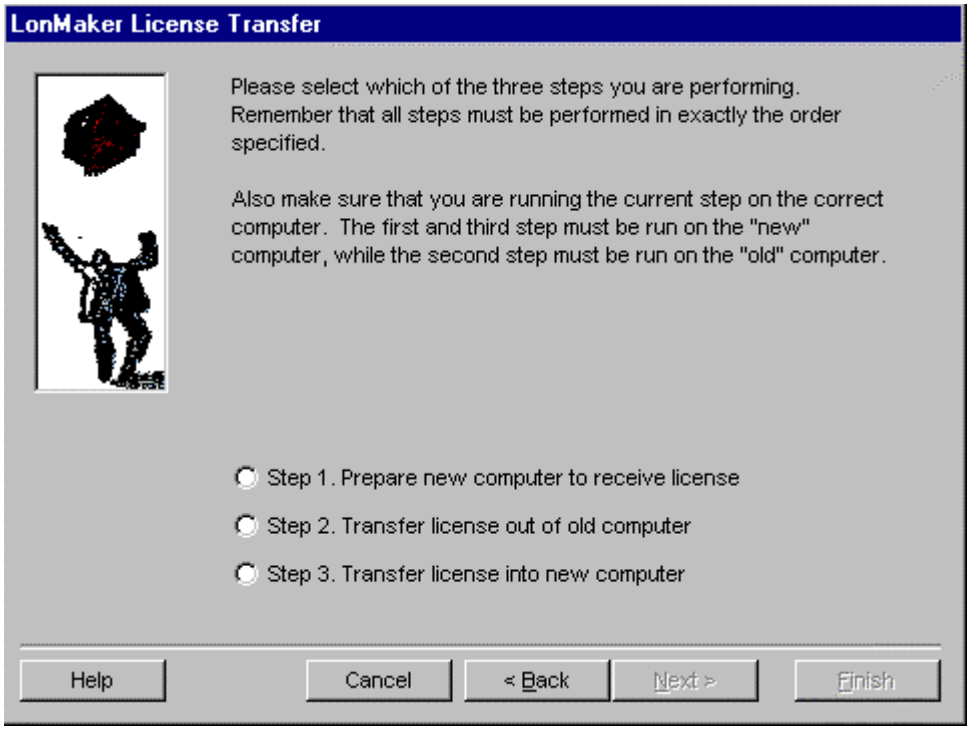
To transfer your LonMaker license from one computer to another, first make sure that you have the LonMaker tool installed on the computer to which you want to transfer your license (the *target computer*). You can use a floppy disk, other removable media, or a shared network drive with read/write permissions to make the transfer.

Caution: Be sure to perform each step of the transfer in order, and on the correct computer or you will lose your license. The *target computer* is the computer you want to license. The *source computer* currently contains the license you want to transfer to the target computer. If you lose your license, you can order free replacement credits as described under *Adding LonMaker Credits*.

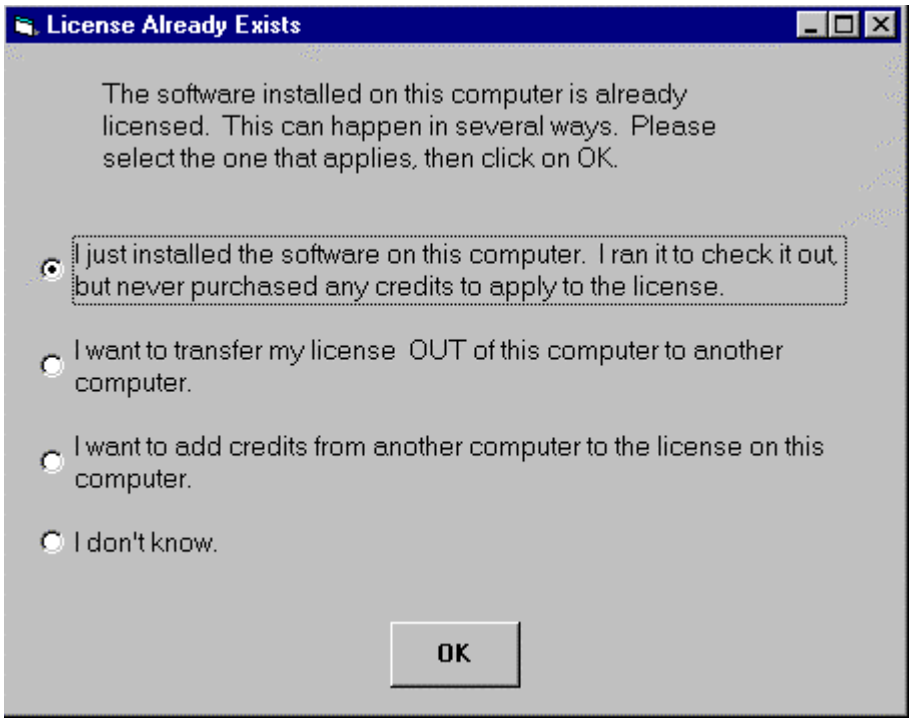
Follow these steps to transfer your license:

On the target computer:

1. Open the *LonMaker for Windows* program folder in the Windows *Start* menu and start the *LonMaker License Transfer Utility* on the target computer. The LonMaker License Transfer window appears. Read the information on this window and click **Next**.

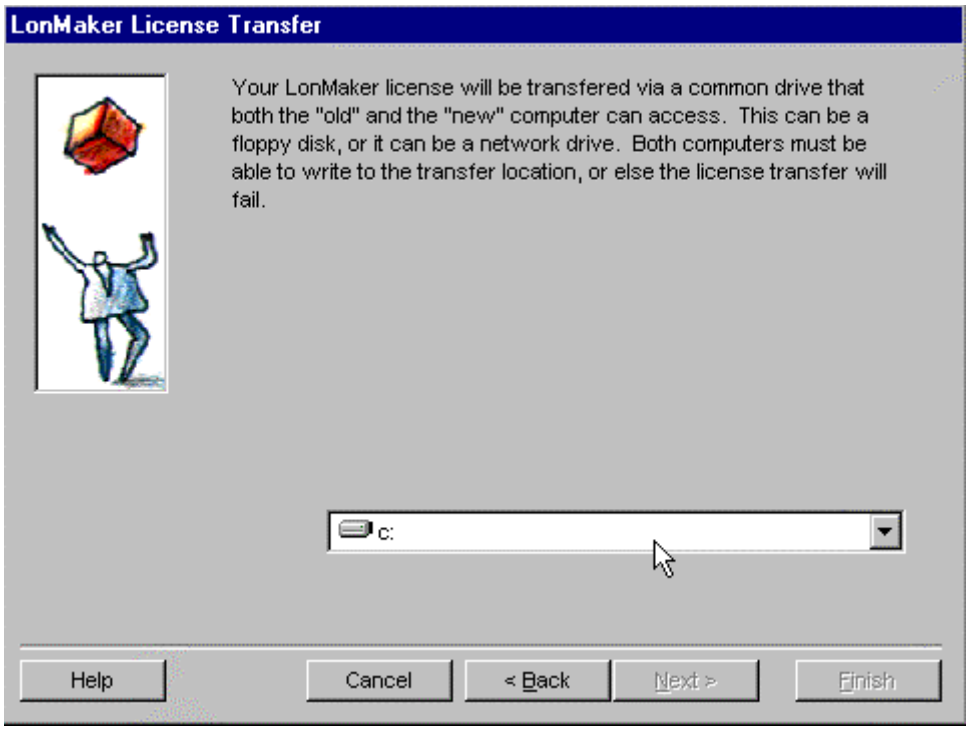

LonMaker License Transfer
Please select which of the three steps you are performing. Remember that all steps must be performed in exactly the order specified.
Also make sure that you are running the current step on the correct computer. The first and third step must be run on the "new" computer, while the second step must be run on the "old" computer.
Step 1. Prepare new computer to receive license
Step 2. Transfer license out of old computer
Step 3. Transfer license into new computer
Help
Cancel
< Back
Next >
Finish

2. Set **Step 1. Prepare New Computer to Receive License** and click **Next**. If the License Transfer Utility detects a LonMaker license on the target computer, the following dialog appears:


License Already Exists
The software installed on this computer is already licensed. This can happen in several ways. Please select the one that applies, then click on OK.
I just installed the software on this computer. I ran it to check it out, but never purchased any credits to apply to the license.
I want to transfer my license OUT of this computer to another computer.
I want to add credits from another computer to the license on this computer.
I don't know.
OK

Caution	*Do not run `Step 1` of the License Transfer Utility on your source computer. If you run `Step 1` on the source computer, you will lose your license.*

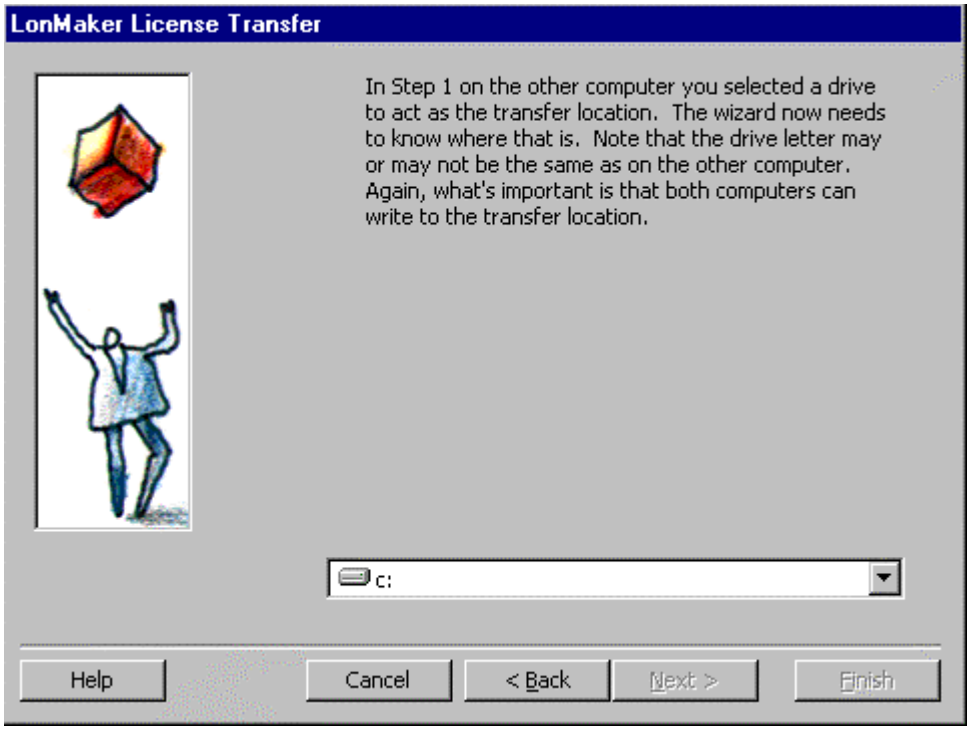
3. Select the first option to confirm that you are on the target computer and that you can overwrite the LonMaker credits already on the target computer.
4. Perform any actions specified by the License Transfer Utility. The following window appears.


LonMaker License Transfer
Your LonMaker license will be transfered via a common drive that both the "old" and the "new" computer can access. This can be a floppy disk, or it can be a network drive. Both computers must be able to write to the transfer location, or else the license transfer will fail.
c:
Help
Cancel
< Back
Next >
Finish

5. You can transfer your license using either a floppy disk or a shared network drive with read/write access for both the target and the source computers. Specify the drive location where you want to transfer the license temporarily and click **Next**. A window appears telling you to go to the source computer and run the wizard again. Click **Finish**.

On the source computer:

1. If you are using a floppy disk to transfer the license, insert the floppy disk into the source computer.
2. Open the LonMaker for Windows program folder and start the License Transfer Utility on the source computer. Click **Next** on the welcome window.
3. Select **Step 2. Transfer License Out of Old Computer**. The following window appears.


LonMaker License Transfer
In Step 1 on the other computer you selected a drive to act as the transfer location. The wizard now needs to know where that is. Note that the drive letter may or may not be the same as on the other computer. Again, what's important is that both computers can write to the transfer location.
c:
Help
Cancel
< Back
Next >
Finish

4. Specify the drive location to which you want to transfer the license temporarily and click `Next`.

On the target computer:

1. If you are using a floppy disk to transfer the license, insert the floppy disk into the target computer.
2. Open the LonMaker for Windows program folder and start the License Transfer Utility again. Click **Next** on the welcome window.
3. Select **Step 3. Transfer License into New Computer** and click **Next**. The License Transfer Utility transfers the license to the target computer.

You can now run the LonMaker tool on your target computer and it is disabled on the source computer. To install a new LonMaker tool on the source computer, you must license a new copy of the LonMaker tool and order a new LonMaker license. You can order a new LonMaker license using the same form and procedure described under *Adding LonMaker Credits*.

Caution	*Transferring a license from a source computer to a target computer* replaces *the license on the target computer. If the license on the target computer contained any LonMaker credits prior to the transfer, the transfer will delete the credits.*

9

Using LNS Plug-ins

This chapter provides an overview of LNS Plug-ins and then describes starting a plug-in, getting plug-in information, and re-registering plug-ins.

Using LNS Plug-in Overview

LNS plug-ins are applications that can be started from within the LonMaker tool to perform a specialized task, often relating to a specific type of device or functional block. For example, the LonPoint Plug-in that is included with the LonMaker tool provides LonPoint-specific user interfaces for reading and setting the configuration properties on LonPoint devices. The LonPoint Plug-in may be optionally installed when you install the LonMaker tool as described in *Installing the LonMaker for Windows Integration Tool*, and is documented in the *LonPoint Application and Plug-In User's Guide*. Other device manufacturers may provide plug-ins that you can use with the LonMaker tool to configure their devices. Any plug-in conforming to the LNS plug-in guidelines may be used with the LonMaker tool.

Plug-ins do not have to be specific to a device or functional block type. System-wide plug-ins can provide generic services that may be used with multiple device types. For example, the *LonMaker Browser* is a generic plug-in that can be used with any functional block on any device to view and modify network variables and configuration properties.

Each plug-in can implement multiple commands. For example, the LonPoint Plug-in implements a *Configure* command for each functional block type used in LonPoint devices. Each plug-in command may be associated with a device type, functional block type, a subsystem, system, or an entire network.

Starting a Plug-in

You can start a plug-in from a plug-in command list, or using a default command. Plug-in command lists provide a list of available plug-in commands for an object within your LonMaker drawing. Plug-in command lists are available for any device shape, functional block shape, subsystem page, the entire LonMaker system, and the entire LonMaker network. The second method to start a plug-in is to use a default command. A plug-in can override the default LonMaker *Configure* or *Browse* command for a functional block type. You can display information about the plug-in commands that are installed on your computer and registered for the network, and which commands are default commands, as described in *Getting Plug-in Information*, below.

To start a plug-in using a plug-in command list, follow these steps:

1. For a functional block, device, or subsystem, right-click the shape, or a blank part of the subsystem page and then click **Plug-Ins** on the shortcut menu. For the system or network, open the **LonMaker** menu and select **System Plug-Ins** or **Global Plug-Ins**. The LonMaker Plug-Ins dialog appears. This dialog lists only the plug-in commands that are available for the selected shape, subsystem, system, or to all networks (global).
2. Choose a plug-in command from the command list and click **OK**. The plug-in window opens.
3. To start a plug-in using a default command, right click a functional block or device shape, and select **Configure** or **Browse**. If a plug-in is registered for the selected command and functional block type, the plug-in window opens.

   If you are using LonPoint functional blocks, open the LonPoint Plug-in by right-clicking a LonPoint functional block shape and then clicking **Configure** on the shortcut menu. See the *LonPoint Application and Plug-in* for more information about the LonPoint Plug-in.

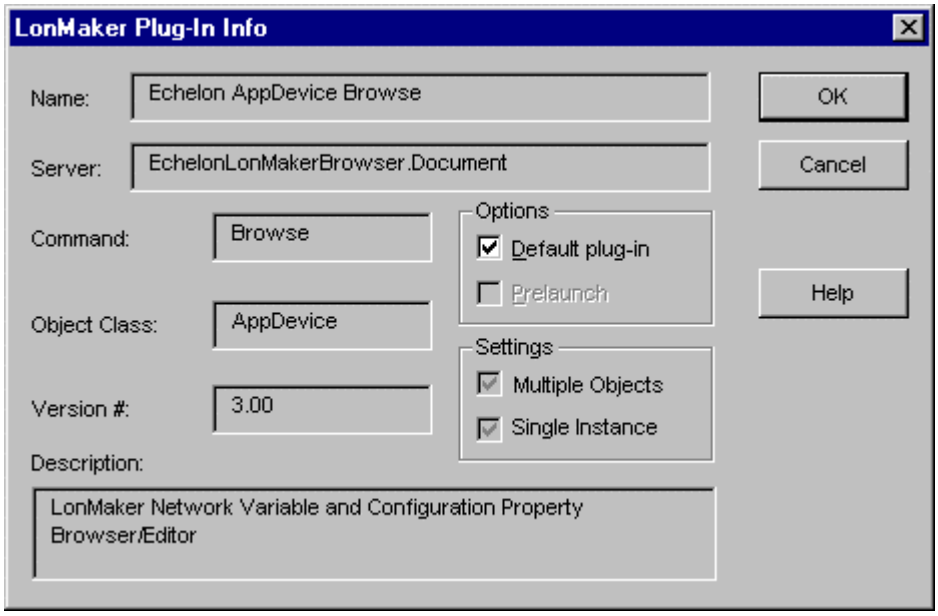
Note: If you try to use a plug-in designed to be used on a functional block on a device's virtual functional block, the plug-in is likely to fail. Plug-ins are typically designed to be used with functional blocks. The virtual functional block is how the LonMaker tool represents the network variables and configuration properties that are not contained by a functional block. The virtual

functional block is not a real functional block, but a convenient way provided by the LonMaker tool to access the portions of a device interface that are not parts of a functional block.

Note: Make sure that all plug-ins you want to use with the LonMaker tool are properly installed and registered. See *Re-Registering Plug-ins* and your plug-in documentation for more information.

Viewing Plug-in Information

To see information about a plug-in, select **System Plug-ins** or **Global Plug-ins** from the **LonMaker** menu, or right-click a LonMaker object and select **Plug-ins** from the shortcut menu. To open the LonMaker Plug-in dialog, select a plug-in, and click **Info**. The following dialog appears.



This dialog contains the following fields:

Name	Displays the name of the plug-in.
Server	Displays the registered ActiveX name for the plug-in.
Command	Displays the command name or number that the plug-in implements.
Object Class	Displays the class of the object on which the plug-in operates for this command.
Version #	Displays the version number of the plug-in.
Default plug-in	Selecting this option registers it as the default application for the specified command and object class. If you set the attribute, the LonMaker tool removes the default attribute from other plug-ins registered for that command and object class. If you clear the default attribute, the LonMaker tool does not change the attribute on any other plug-ins. If multiple plug-ins are registered for the same command and object class, the one with this default option set will be invoked. If multiple plug-ins have the default option set, the LonMaker tool invokes the first plug-in that it finds with this option set.

Prelaunch	Keeps one instance of the plug-in program prelaunched (if registered) for immediate availability to commands that call the plug-in. Whenever you set or clear this option, the LonMaker tool sets/clears it for that plug-in for all networks on that computer. If the plug-in does not support prelaunch capability, the checkbox is disabled.
Multiple Objects	If this option is selected, the plug-in supports multiple objects simultaneously. For example, the LonMaker Browser supports browsing multiple functional blocks. This field is informational only and cannot be changed.
Single Instance	If this option is selected, the plug-in supports using a single instance of the plug-in when it is requested for the same object multiple times. This field is informational only and cannot be changed.
Description	A brief description of the plug-in.

Click **OK** to close the window.

Re-Registering Plug-ins

You may need to register a plug-in that you chose not to register when opening a LonMaker network, or re-register a plug-in due to an update to the plug-in. To register or re-register a plug-in from a LonMaker drawing, follow these steps:

1. Select **Network Properties** from the **LonMaker** menu. The Network Properties dialog appears.
2. Select the Plug-In Registration tab.
3. Choose the plug-in you want to register from the **Already Registered** or the **Not Registered** list. Click **Add**. The plug-in appears in the **To Be Registered** list.
4. Once you have chosen all the plug-ins you want to register or re-register, click **Apply**.
5. After the plug-in is registered, click **OK** to exit the Network Properties dialog.

Refreshing the LonMaker Network

Some LNS plug-ins may make changes to the LNS database. The LonMaker tool sometimes caches changes to the LNS database to improve performance. To force the LonMaker tool to process and release the cache, open the **LonMaker** menu and select **Refresh**.

10

Monitoring and Controlling Devices

This chapter provides an overview of the LonMaker monitoring and control functions and then gives directions on setting Browser options, changing types and formats, monitoring connections, and binding network variables to the host.

Monitoring and Controlling Overview

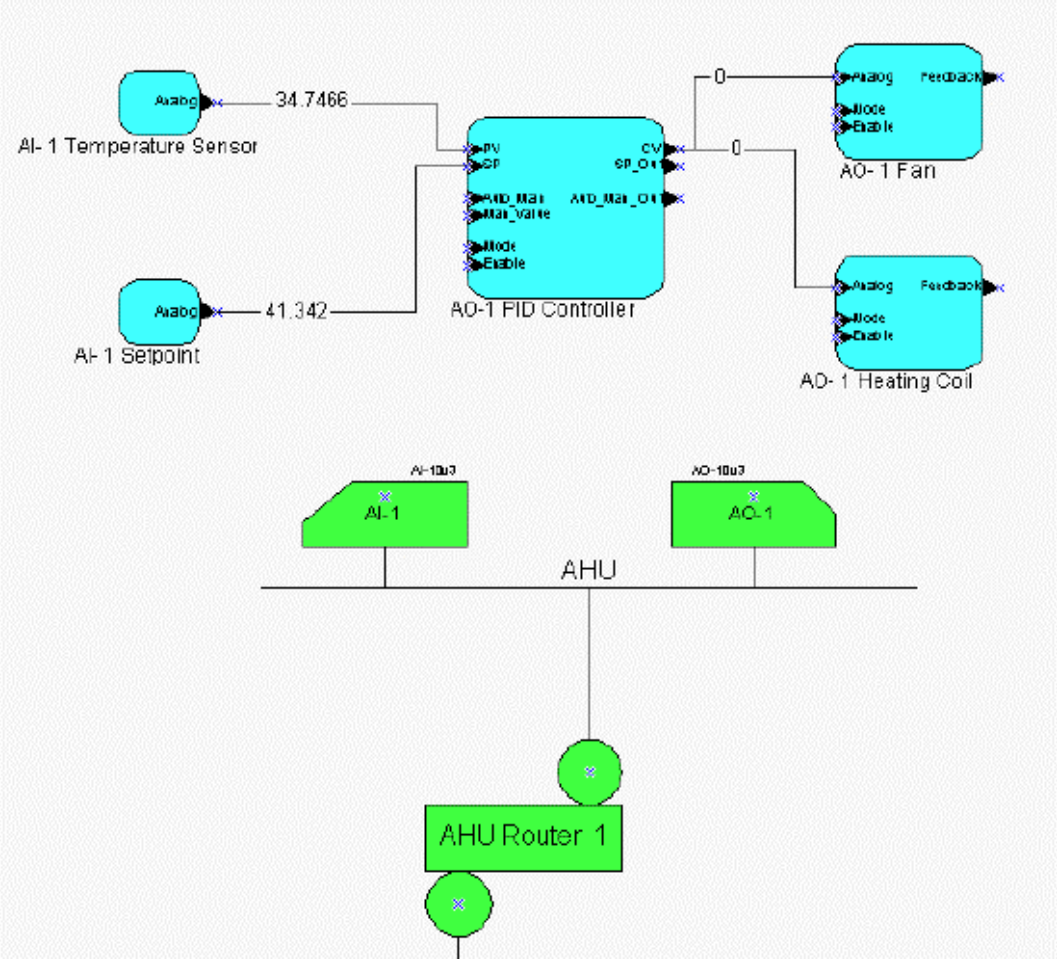
During and after installation, you can monitor a system by reading network variables and configuration properties on devices within your network. You can also control a system by writing network variables and configuration properties on devices within your network.

The LonMaker tool provides the following three methods to read and write network variables and configuration properties:

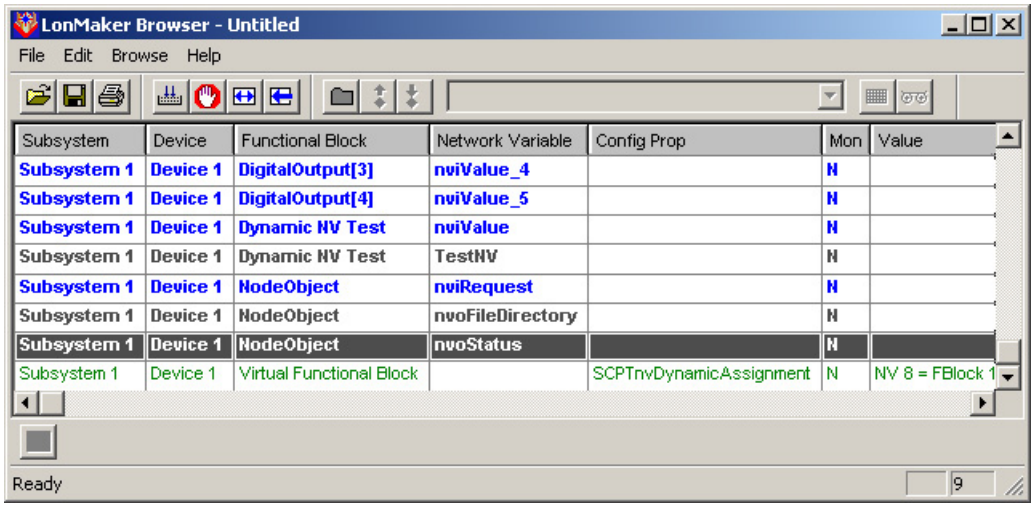
- *Monitored connections*
- *LonMaker Browser*
- *LNS Text Box*

The LonMaker tool is also compatible with other LNS monitoring and control applications, such as the LNS DDE Server.

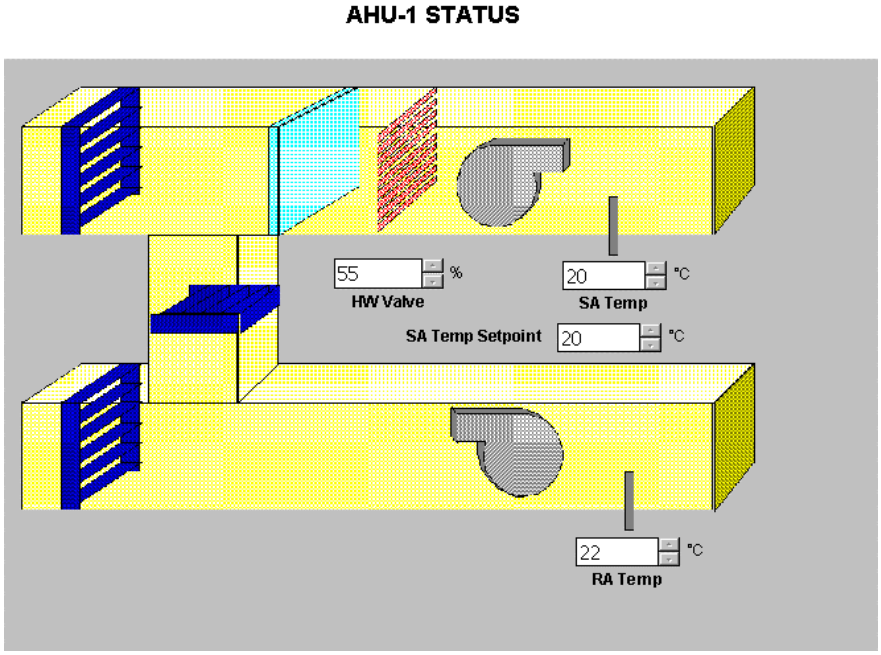
Monitored connections provide a simple means to view network variable values within your network. Using monitored connections, you can view the values of network variables on your LonMaker drawing. This capability is useful for debugging your installation, because monitored connections provide an easy way to visualize the flow of data through your functional blocks. For example, the following figure illustrates monitored connections on a PID controller. The values shown on the connection shapes represent the actual network variable values within the operational system. This method is described in *Monitoring Connections*.



The *LonMaker Browser* is a generic LNS plug-in that can be used to read and write network variables and configuration properties on any functional block on any device. This is useful for getting a detailed view of the operation of any functional block, and for setting configuration properties on functional blocks that do not have *plug-ins*. For example, the following figure illustrates a Browser window for the AI- 1 Temperature Sensor functional block in the previous figure. This method is described in *Using the LonMaker Browser*.


LonMaker Browser - Untitled
File Edit Browse Help
Subsystem Device Functional Block Network Variable Config Prop Mon Value
Subsystem 1 Device 1 DigitalOutput[3] nviValue_4 N
Subsystem 1 Device 1 DigitalOutput[4] nviValue_5 N
Subsystem 1 Device 1 Dynamic NV Test nviValue N
Subsystem 1 Device 1 Dynamic NV Test TestNV N
Subsystem 1 Device 1 NodeObject nviRequest N
Subsystem 1 Device 1 NodeObject nvoFileDirectory N
Subsystem 1 Device 1 NodeObject nvoStatus N
Subsystem 1 Device 1 Virtual Functional Block SCPTnvDynamicAssignment N NV 8 = FBlock 1
Ready
9

The *LNS Text Box* is an ActiveX control that can be used to monitor the value of any network variable, configuration property, or functional block override in a LONWORKS network. ActiveX controls are a Windows-standard method to add third-party user interface components to your LonMaker drawing. Using ActiveX controls, you can create simple human-machine interface (HMI) applications within your LonMaker drawing. For complex HMI applications, you will want to use a full-featured LNS-compatible HMI such as Wonderware InTouch. The LNS Text Box control is provided with the LonMaker tool. This sample control allows you to experiment with the use of ActiveX controls within your LonMaker drawing. For example, the LNS Text Box control can be used to create the following control panel for the PID controller example shown in the previous two figures. This method is described in *The LNS Text Box*.



Changing Types and Formats

Every network variable and configuration property has an associated type and format. The *type* specifies the units and structure of the data contained within the network variable or configuration property, and the *format* specifies how the raw data contained within a network variable or configuration property is translated for display or for use by an application; the format also specifies how data entered by a user or application is translated to the raw data to be transmitted on a LONWORKS network. The type of a network variable or configuration property is typically fixed for most devices; however, devices may support network variables and configuration properties with changeable types as described by the *LONMARK Application Layer Interoperability Guidelines*. The format of a network variable or configuration property is very flexible, and may be changed for any network variable or configuration property. The format may include scaling and offset values to convert one type of data to another, such as Celsius to Fahrenheit or kilograms to pounds, may include localized formatting specifications, and may also include text strings to be displayed as part of the value.

For example, a temperature sensor may report a temperature value with a type of `SNVT_temp_f`. The `SNVT_temp_f` type is defined as a 32-bit signed floating point value representing a Celsius temperature with a range of -273.17 to 1E38 degrees. A value of `SNVT_temp_f` type may be displayed and entered using one of several formats such as Celsius, Fahrenheit, or differential Fahrenheit (Fahrenheit has an offset of 32, differential Fahrenheit has an offset of 0).

The format of a network variable or configuration property does not affect how the corresponding value is transmitted on the network. For example, a `SNVT_temp_f` value is always transmitted as a Celsius value, but may be displayed as a Celsius, Fahrenheit, or differential Fahrenheit value.

Each type has a default format. You can change the format at any time, but if you change a type, the format is automatically changed to the default format for the new type. You may change the format to a format associated with a different type than the actual network variable type. For example, a network variable may have a fixed type of `SNVT_count_f`, but you may set its format to `SNVT_temp_f#SI` to interpret the count value as a Celsius temperature.

Types and formats are defined in resource files. Resource files for both the LONMARK standard and Echelon user-defined types are included with the LonMaker tool. Device manufactures may also supply their own resource files for their user-defined types and formats. These are typically installed with the manufacturer's plug-in.

Type names are defined in the resource files. Format names are always based on the type name, and may include an alternate format specifier separated from the type name by a pound sign (#). For example, the `SNVT_switch` type has a single format called `SNVT_switch`. The `SNVT_temp_f` type has three formats called `SNVT_temp_f#SI`, `SNVT_temp_f#US`, and `SNVT_temp_f#US_diff`. You can modify these formats or create your own using the Resource Editor included with the NodeBuilder tool.

Many standard network variable types include formats with "#US" and "#SI" format specifiers. These are used to identify default formats where the appropriate default is determined by the regional settings on the computer running the LonMaker tool. The LonMaker tool uses the #US formats when your Windows regional settings specify a US measurement system, otherwise the LonMaker tool uses the #SI formats. How to view the measurement system depends on your operating system

In Windows 2000 or Windows 98:

1. Open the **Windows Control Panel**
2. Double-click **Regional Settings**. The **Regional Settings** dialog opens.
3. Click the **Numbers** tab. The **Measurement System** field displays the units that will be used (US or Metric).

In Windows XP:

1. Open the **Windows Control Panel**
2. Double-click **Regional and Language Settings**. The **Regional and Language Settings** dialog opens.
3. Click **Customize**. The **Customize Regional Settings** dialog opens. The **Measurement System** field displays the units that will be used (US or Metric).

The type and format of a network variable or configuration property is saved in the LNS network database. You can modify either using the *LonMaker browser*. These changes affect how the LonMaker tool displays network variable or configuration property values in the browser, *connection monitoring*, or the *LNS text box*. These changes may also affect how these values are displayed by other LNS applications.

Monitoring Connections

You can monitor the value of network variables in a connection in a LonMaker network, whether the connection uses a Connector shape or reference connection.

Note: You must enable monitoring before you can monitor connections. To enable monitoring, right-click on a blank space in your LonMaker drawing and set **Enable Monitoring** on the shortcut menu.

To monitor a connection, double-click the connector shape or right-click the connector shape and select either **Monitor Input Value** or **Monitor Output Value**. The value of the connected input or output network variable displays on the Connector shape (the first time you double-click a Connector shape, the input network variable is displayed). You can choose to monitor both the input and output network variables at the same time. Double-click the connection shape to change the monitored network variable from input to both to output to none.

To monitor a reference connection, right-click the side of the connection you want to monitor and then click **Monitor Value** on the shortcut menu. The value of the network variable on the side of the connection you chose displays on the connector shape.

To check the value of a connection without enabling continuous monitoring, right-click the connector shape and then click **Get Input Value** or **Get Output Value** on the shortcut menu. The current value of the network variable displays on the Connector shape. As with monitoring, the Get Value commands may also be used on connector shapes that are only connected at one end. The value is displayed for 15 seconds. You may change the length of time the value is displayed in the Network Properties>LonMaker Options>NV Browser dialog.

If you are monitoring a Connector shape that represents a connection between multiple network variable pairs, only the first pair is monitored.

Because monitoring connections can interfere with the successful completion of network operations, for example, while commissioning a device, the LonMaker tool disables monitoring while the operation is in progress.

For more information on monitoring network variable values, see *Monitoring Network Variables*.

The LonMaker Browser

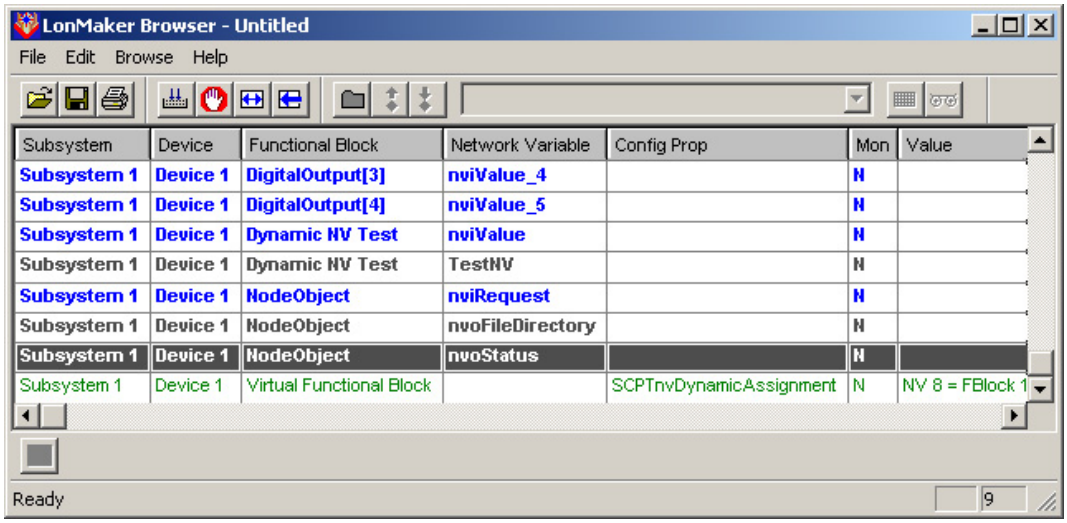
The LonMaker Browser allows you to view and modify network variables and configuration properties on one or more functional blocks, or all functional blocks and variables on a device.

Many functional blocks, such as those provided with Echelon's LonPoint devices, may come with their own device plug-ins that provide a custom interface for their network variables and configuration properties. However, the LonMaker Browser has the advantage of versatility: it

allows you to read and modify network variables and configuration properties on any functional block on any device.

The LonMaker Browser is a plug-in included with the LonMaker tool. It can be registered as described in *Creating a LonMaker Network*. Once it is registered for one network, it is available to all other networks on the same computer.

To start the LonMaker Browser, select one or more functional blocks and/or devices, right-click one of them, and then click **Browse** on the shortcut menu. This selection opens the browser and lists all the network variables and configuration properties on those functional blocks and devices. Select **Browse** for additional functional blocks while the LonMaker Browser is open to add the network variables and configuration properties associated with the additional functional blocks to the bottom of the existing LonMaker Browser window. The LonMaker browser appears as shown in the following figure:


LonMaker Browser - Untitled
File Edit Browse Help
Subsystem Device Functional Block Network Variable Config Prop Mon Value
Subsystem 1 Device 1 DigitalOutput[3] nviValue_4 N
Subsystem 1 Device 1 DigitalOutput[4] nviValue_5 N
Subsystem 1 Device 1 Dynamic NV Test nviValue N
Subsystem 1 Device 1 Dynamic NV Test TestNV N
Subsystem 1 Device 1 NodeObject nviRequest N
Subsystem 1 Device 1 NodeObject nvoFileDirectory N
Subsystem 1 Device 1 NodeObject nvoStatus N
Subsystem 1 Device 1 Virtual Functional Block SCPTnvDynamicAssignment N NV 8 = FBlock 1
Ready
9

The LonMaker browser color codes the configuration properties and network variables in the following manner:

Blue	Input network variables. The browser can write values to these network variables. See *Modifying Network Variable and Configuration Property Values.*
Green	Writable configuration property. The browser can write values to these configuration properties. See *Modifying Network Variable and Configuration Property Values*.
Grey	Output network variables and read-only configuration properties. The browser cannot write to these items.

Note: If another plug-in opens when you click **Browse**, the other plug-in was registered after the LonMaker Browser and specified that it is the default browser. To change the default browser, right-click a functional block and then click **Plug-ins** on the shortcut menu, select the unwanted browser, click **Info**, and clear **Default**.

Once a browser window is opened, it remains open until you close it. Even if you close the LonMaker drawing, the browser continues to run until you close it. If you open a Browser window, close the LonMaker drawing, then open another browser, both Browser windows run concurrently.

When the LonMaker Browser opens, it displays all the configuration properties and network variables in the selected functional blocks or devices. If the Browser window is already open, the configuration properties and network variables are added to the open window.

The toolbar at the top of the Browser window provides shortcut commands. The toolbar includes a **Value** field that you can use to update configuration property and network variable values. Each row in the browser contains the following information about a network variable or configuration property:

Subsystem	Displays the name of the subsystem in which the network variable or configuration property's functional block resides.
Device	Displays the name of the device in which the network variable or configuration property's functional block resides.
Functional Block	Displays the name of the functional block in which the network variable or configuration property resides.
Network Variable	Displays the name of the network variable that the row describes if the row describes a network variable. If the row describes a configuration property associated with a specific network variable, this column shows that network variable. Otherwise, this column is blank.
Config Prop	Displays the standard or user-defined type of the configuration property if the row describes a configuration property. (see types.lonmark.org) If a row describes a network variable, this column is blank.
Mon	Indicates whether the network variable is monitored. A "**Y**" indicates that monitoring is on; a status indicator follows the "**Y**", indicating when a new value is received by the browser. Monitoring cannot be turned on for configuration properties.
Value	Contains the value of the network variable or configuration property. If a monitored network variable, this value is updated through network variable polling or bound updates as described under *Monitoring Network Variables*. The polling or minimum update interval is set by **Poll Interval** on the Network Variables tab of the Browser Options dialog.

Two fields in the lower right corner of the browser window provide additional information. The left one indicates whether Caps Lock is on. The right one indicates which row of the current browser window is currently selected.

The LonMaker Browser Toolbar

The browser toolbar provides a fast way to perform many browser functions. The toolbar contains the following buttons:

Open	Opens an existing browser file. See *Customizing the Browser*.
Save	Saves changes to a browser file. If the browser file is new, the `Save As` dialog displays. Name the file and choose a folder in which to save the file. See *Customizing the Browser* for more information.
Print	Prints the data in the Browser window.
Monitor All On	Turns on monitoring for all network variables displayed in the current Browser window. See *Monitoring Network Variables* for more information.
Monitor All Off	Turns monitoring off for all network variables in the current Browser window. See *Monitoring Network Variables* for more information.

	Adjust Columns	Automatically sizes each column displayed in the Browser window to fit the longest string in that column.
	Refresh All	Updates the Browser window with all current network variable and configuration property values. If any names of the displayed objects have been changed using another tool, the displayed names are updated.
	Properties	Allows you to view and set properties for the currently selected network variable or configuration property object. See *Modifying Network Variable and Configuration Property Properties* for more information.
	Get Value	Refreshes the value for the currently selected network variable or configuration property. You can only update network variable values if you are attached to the network.
	Set Value	Changes the value of the currently selected network variable or configuration property to the value indicated in the `Value` field located right of this button. For enumerated values, click the down arrow to select from the possible values. Network variable values can only be modified if you are attached to the network.
	Table	Opens a dialog that displays the selected configuration property values in a table (only for configuration properties that contain a list or table of values). See *Modifying Network Variable and Configuration Property Values* for more information.
	Details	Displays the details of the selected network variable or configuration property. See *Modifying Network Variable and Configuration Property Values* for more information.
	Display Messages	Displays a log of error messages received while the browser is active. The `Display Messages` button is located at the bottom left corner of the browser. See *Displaying Error Messages* for more information.

Monitoring Network Variables

You can use the LonMaker Browser to monitor network variables. Use this feature to see the value an output network variable is sending to the network or the value an input network variable is receiving from the network.

To turn on monitoring for a network variable, right-click the network variable row you want to monitor and then click **Monitor** on the shortcut menu. When a selected network variable is being monitored, this option is set in the shortcut menu. If you want to monitor all network variables, right-click any network variable and then click **Monitor All On** on the shortcut menu or click the **Monitor All On** button on the browser toolbar.

The Mon column for monitored network variables changes to '**Y**' and the Value column displays the current network variable value. The browser blinks a status indicator next to the '**Y**' when a new value for the monitored network variable appears. Options related to network variable monitoring are described in *Browser Options: Network Variables*.

By default, the browser polls network variables at the rate specified on the Network Variables tab of the Browser Options dialog as described in the previous section. The browser does not poll monitored output network variables if they are connected to the browser computer as described in the next section.

To turn off monitoring for a network variable, right-click the network variable and then click **Monitor** or **Monitor All Off** on the shortcut menu. You can also click the **Monitor All Off** button on the browser toolbar.

You can also find the value of a network variable manually. Right-click the network variable for which you want to find a value and then click **Get Value** on the shortcut menu or click the **Get Value** button on the browser toolbar. You can update all network variable values by clicking the **Refresh All** button ( ) or selecting **Refresh All** on the *Browse* menu.

Using Bound Updates

Monitoring Network Variables describes how the browser can poll network variables periodically to track their value. This capability is useful when the network variable value changes rapidly. If the network variable value changes rarely, polling causes unnecessary network traffic. If you are monitoring many slowly changing network variables, you can reduce the network traffic required by either reducing the polling rate or using *bound monitoring*.

Bound monitoring creates a connection between the network variable being monitored and the browser. To turn on bound updates, right-click a network variable in the browser and then click **Properties** on the shortcut menu. Open the Monitoring tab and set **Bind this Network Variable to the Browser for Receiving Network Variable Updates**. This creates an *implicit connection* to the browser. An implicit connection is a network variable connection that is automatically created by the browser. You can also explicitly create bound connections to the LonMaker browser which are in turn automatically used by the browser instead of polling as described in *Binding Network Variables to the Host*.

Each implicit connection requires a network variable on the LonMaker computer, and consumes network variable binding resources on the sending device or devices. This creates unnecessary network variables and consumes unnecessary resources if you are using bound monitoring with many network variables of the same type. To reduce the number of network variables on your computer and reduce network variable binding resource consumption, try one of the following:

- Use polled monitoring by clearing **Bind this Network Variable to the Browser for Receiving Network Variable Updates**.
- Explicitly bind the network variable to the host as described in *Binding Network Variables to the Host*.
- Use aliases on the devices that are bound to the fan-in connection.
- Define more aliases on the device containing the network variable with the fan-in connection.

Modifying Network Variable and Configuration Property Values

The LonMaker Browser allows you to change the values of writable configuration properties and input network variables (you cannot change output network variable values and read-only configuration properties). For more information on specific standard configuration property and network variable types, see types.lonmark.org. For more information on user configuration property and network variable types, see the documentation included with the functional blocks on which the configuration properties and network variables reside. For information on creating and using user types, see the *LONMARK Resource File Developer's Guide* in the *LNS Utilities and LONMARK Reference* Help file.

Some configuration properties and network variables contain a single value; some configuration properties contain a table of values. The configuration property or network variable documentation indicates which.

To modify the value of a network variable or configuration property, click the network variable or configuration property in the Browser window. Enter the new value in the Value field on the Browser toolbar, or choose a value from the drop-down list if you are changing an enumeration value. Click the **Set Value** button on the Browser toolbar, or right-click the object you are changing and then click **Set Value** on the shortcut menu. The value is updated in the Value column. If you have entered an invalid value, an error message is displayed in a Display Message dialog.

Network variables or configuration properties with multiple fields or entries are easier to view and modify using the **Details** or **Table** commands in the shortcut menu for the network variable or configuration property, or the **Details** or **Table** buttons on the Browser toolbar. The **Details** command provides a detailed field list showing the types and value of each field. The **Table** command provides a detailed table view of configuration properties.

To modify a configuration property or network variable value using the Details view, right-click it and select **Details** or click the **Details** button on the Browser toolbar. The Object Details dialog appears:

If a configuration property contains a table of values, right-click the configuration property and then click **Table** on the shortcut menu or click the **Table** button on the Browser toolbar. The Edit Configuration Property Table dialog appears.

You can clear the displayed value of a network variable or configuration property by right-clicking the object you want to clear and then clicking **Clear Value** on the shortcut menu. To clear all values on the browser display, select **Clear All Values** from the **Browse** menu. Clearing the values from the browser display does not affect the values in the functional block.

Once you have cleared or changed the values of configuration properties and network variables, you may want to view a refreshed list of values for the functional block. To get a current value for a single configuration property or network variable, right-click the object and then click **Get Value** on the shortcut menu or click the **Get Value** button ( ) on the browser toolbar. The new value displays in the Value column.

To see current values for all configuration properties and network variables in the Browser window, open the **Browse** menu and select **Refresh All** or click the **Refresh All** button ( ) on the browser toolbar. The new values display in the `Values` column.

Modifying Network Variable and Configuration Property Properties

You can display properties for any network variable or configuration property that has several properties that may be read. These properties include monitoring options, type, length, direction, and service attributes for network variables; and length, type, mode, default value, and flags for configuration properties. To see these properties, right-click a configuration property or network variable in the browser window and then click **Properties** on the shortcut menu. Click **Help** on the Properties dialog for more information about the properties that can be set on that page.

Displaying Error Messages

By default, any errors generated while browsing the network variables or configuration properties in the Browser window are displayed in the following Messages dialog:

If you don't want the Messages dialog to show automatically every time an error message is generated, set **Stop Automatic Display** in the messages dialog or clear **Error Messages: Show Always** under **General Browser Options**.

To view the Messages dialog from the browser, open the **Browser** menu and then click **Display Messages**. You can also click the **Display Messages** button at the bottom left corner of the Browser window. If the icon is gray, no messages are available and you cannot open the dialog.

To clear the Messages display, click **Clear**. All error messages are cleared from the window and the `Message` option is disabled if you close the cleared dialog.

Managing Functional Blocks

You can use the **Manage** command in the **Browse** menu to test and modify functional blocks. See *Managing Devices, Functional Blocks, and Routers* for more information.

Network Variable/Configuration Property Details

This dialog contains the value of the entire configuration property or network variable in **Object Value**. You may change this value or, if the configuration property or network variable in question has enumerated values, a list at the bottom of the dialog displays all possible values.

If the configuration property or network variable format specifies that the configuration property or network variable contains a list of values or fields (for example, the `SCPTminSndT` configuration property format has `Day`, `Hour`, `Minute`, `Second`, and `Millisecond` fields), **Field List** displays all the fields in the configuration property or network variable. To display and modify each value, click the plus ("+") to the left of the field name and single click twice on the value (slower than double-click). **Field List** also allows you to access all members of a table, but the **Table** command provides an easier-to-use interface for tables.

Click **OK** or **Apply** to change the configuration property or network variable. If you set an unsupported value, an error message appears in the Display Messages dialog.

Configuration Property Table

If a configuration property contains a two dimensional table, you can view it in table form. Right-click the configuration property and then click **Table** on the shortcut menu. The Edit Configuration Property Table dialog appears.

This dialog contains a table of all values in the configuration property. To change a value, select the value to be changed and enter the new value in **Change Data Here for Selected Entry** and press `Enter`. Click **OK** or **Apply** to change the configuration property.

Changing Network Variable Type

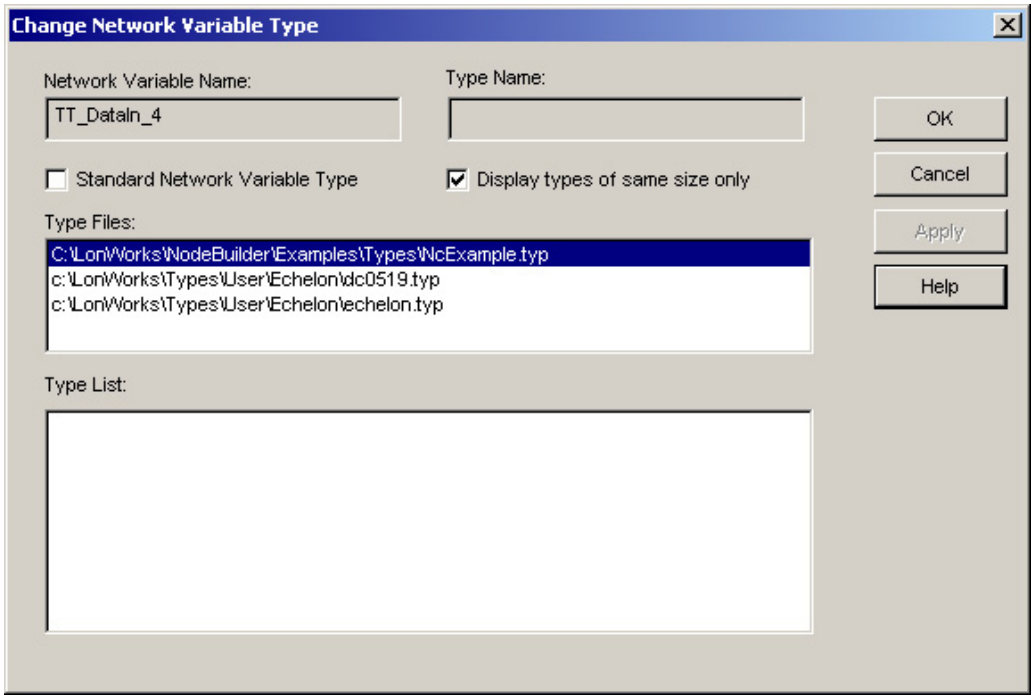
The LonMaker Browser allows you to change the type of network variables with changeable types. When you change the network variable type, the browser updates the type in the LNS network database, updates the type in the physical device if OnNet, and automatically chooses a format for displaying the network variable data that matches the type, provided one is available. For example, an analog input device may be hooked to a variety of input devices, such as temperature sensors, pressure sensors, or dials. If the input device measures temperature, the SNVT_temp_f network variable type is used to define the value as a temperature. If the input device measures air pressure, the SNVT_press_f type is used to define the value as a pressure.

See the *LNS Utilities and LONMARK Reference* Help file for more information on standard network variable types. Not all network variables have changeable types, so you should check the documentation of the device and functional block you are browsing to determine whether the browser will allow you to change a specific network variable's type. Many of the network variables on the LonPoint devices support changeable types as described in *LonPoint Application and Plug-in Guide*.

Network variables with a changeable type will always have an associated SCPTnvType configuration property (or, in the case of some Echelon devices, a UCPTnvTypeInfo configuration

property defined in the Echelon resource file set) that keep track of their type. When the type of a network variable is changed using the LonMaker browser, this configuration property is automatically updated.

To change a network variable type, right-click the network variable and then click **Change Type** on the shortcut menu. This menu item is only available for network variables with changeable types. The Change Network Variable Type dialog appears, as shown in the following figure:



Set **Standard Network Variable Type** to select the type from the SNVTs detailed in the SNVT Master List. Clear this option to select a type from the available user-defined types.

Set **Display Types of Same Size Only** to view only network variable types of the same size as the selected network variable. Although it is possible to change a network variable to a type which is a different length than the original network variable, this change is generally not supported; and, if supported, it may also require changes to associated configuration properties. Check the documentation for the functional block to verify that it supports changes to types with different lengths before making changes. Failure to follow the correct procedures could result in unpredictable behavior.

When you change the type or format of a network variable, the change may not be reflected in network variables and configuration properties that are being monitored by the LonMaker tool. To update the types and formats, resynchronize the network with **Sync Monitor Sets** as described in *Resynchronizing the Drawing, Database, and Network*.

Changing Network Variable/Configuration Property Format

The LonMaker Browser allows you to change the format of all configuration property and network variable values. The format selected determines how its data is formatted and how input data is interpreted. The format is saved in the LNS network database, but it does not affect the network variable or configuration property type and does not affect the data on the physical network.

To change the format of a configuration property or network variable, right-click the configuration property or network variable and then click **Change Format** on the shortcut menu. The Change Format dialog appears.

To select a new format, set the **Precision** value to determine the precision for configuration property and network variable types that use floating point numbers. This value specifies the number of digits displayed after the decimal point. If the selected format does not contain a floating point number, the **Precision** value is ignored.

In addition to the formats contained in the standard format file and other format files, you may choose to format the data in one of five built-in data types: *Integer*, *Real*, *Raw (Decimal)*, *Raw (Hex)*, or *String*. Select *Built-in data types* from **Format Files** to choose one of these formats.

When you change the type or format of a network variable, the change may not be reflected in network variables and configuration properties that are being monitored by the LonMaker tool. To update the types and formats, resynchronize the network with **Sync Monitor Sets** as described in *Resynchronizing the Drawing, Database, and Network*.

Customizing the Browser

When you open the browser, by default it contains all the network variables and configuration properties for the selected functional blocks or devices. You can hide rows and columns in the browser to make it easier to find the data you want to work with. For example, your network might contain only one subsystem so you would hide the subsystem column, or there might be configuration properties that are set at manufacturing time that you do not want to see. For this reason, you can customize the browser to hide information you do not need to view or change.

Customizing Browser Columns

When you first open the browser, all columns are visible. To hide one or more of the columns in the browser, select **Customize** from the **Browse** menu. The Customize dialog appears.

Select the columns you do not want to view and then click the **>>** button to move them to the **Columns Not Visible** list. The browser displays only the columns you did not hide. You cannot hide the Value column.

Change the order of the columns using the **Move Up** and **Move Down** buttons.

You can adjust the width of the columns in the browser to efficiently display information. Choose **Adjust Columns** from the **Browse** menu, or click the **Adjust Columns** button in the browser toolbar. The browser automatically resizes the columns to display the longest text string in each column.

Customizing Browser Rows

To hide a configuration property or network variable from the display, select the configuration property or network variable to be hidden and press the Delete key. You can also select the row you want to hide and choose **Delete Row** from the **Edit** menu. The browser hides the selected row. This selection does not affect the configuration property or network variable itself.

To hide all configuration properties and network variables, select **Delete All Rows** from the **Edit** menu and click **OK** on the warning dialog.

To show only configuration properties or network variables, select the appropriate options in **Browser Options: General**.

To show configuration properties or network variables you have hidden select **Undelete** *Row* from the **Edit** menu. A dialog containing all hidden configuration properties and network variables appears. See *Undo Delete*.

Select the item or items you want to show, or set **Select All** to select all items. Click **OK** or **Apply**. The configuration properties and network variables you chose appear in the browser.

Saving Browser Customization

Once you have customized the browser to display only the desired configuration properties and network variables in the functional block or blocks you are browsing, you can save these customizations by selecting **Save** or **Save As** from the **File** menu. The customization is saved to a browser (.brw extension) file.

To reopen a browser file, open the **Start** menu and point to the **LonMaker for Windows** program folder. Select **LonMaker Browser** from the menu. An empty browser opens. Alternately, you can right-click a functional block and then click **Browse** on the shortcut menu to open a new browser. Select **Open** from the **File** menu to open the saved Browser file you want to browse. You can also double-click the browser file to be opened in Windows Explorer.

To print a browser file, click the **Print** button on the browser toolbar or select **Print** from the **File** menu. To preview the file as it will be printed, open the **File** menu and select **Print Preview**. To return to the browser window from print preview, click the **Close** button.

Setting Browser Options

To set LonMaker Browser options, open the **Browse** menu and select **Options**. The following topics describe the tabs of the browser options dialog.

Browser Options: General

This tab contains general options that affect the operation of the LonMaker Browser. The options set in this dialog apply to all browser sessions for all networks. This tab contains the following options:

Catalog Directory — Lists the directory containing the resource catalog. The resource catalog lists the directories containing the resource files used in this network. These files determine how network variables and configuration properties are displayed. This field is read-only. See *The LNS Resource File Catalog Utility User's Guide* and the *LONMARK Resource File Developer's Guide* in the *LNS Utilities and LONMARK Reference* Help file for more information.

Current User Name — Displays the name of the current LonMaker user. This field is read-only.

Display — Sets display options for the LonMaker Browser. You can choose to display **Network Variables**, **Configuration Properties**, or **Both**. Click one button, then click **OK**, and the browser displays the option you chose. The option you select remains selected every time you open a new browser.

Set **Sort NVs by Name** to list network variables alphabetically in the browser. If this option is cleared, they are listed by network variable index. Changes to this option do not affect the current browser window. To update the display, close and restart the browser.

Error Messages — Enables error messages to be displayed in a dialog when new errors occur. If you disable the `Show Always` option, you can open the message dialog by clicking the **Display Messages** button. Select **Show Always** if you want error messages displayed.

Browser Options: Messaging

This tab allows you to set options which determine how the browser communicates with the physical devices. The options set in this dialog apply to all browser sessions for the current network. This tab contains the following options:

Number of Retries	Sets the number of times the browser sends a message using acknowledged or repeated messaging.
Service Type	Determines whether network variables are updated using **Acknowledged**, **Unacknowledged**, or **Repeated** messaging. You can change this option to **Unacknowledged** or **Repeated** messaging even if the object requires authentication based on the network configuration. However, if you try to update a network variable in an authenticated connection, the network variable is not updated.
Priority	Determines whether the browser uses priority messaging to poll and update network variables.

Browser Options: Configuration Properties

This tab allows you to set options that determine which configuration properties are displayed by the browser. The options set in this dialog apply to all browser sessions for all networks. This tab contains the following options:

Show Manufacture Time Configuration Properties	Enables and disables the display of manufacturing time configuration properties.
Show Constant Configuration Properties	Enables and disables the display of constant configuration properties.

Browser Options: Network Variables

This tab allows you to set options which determine how network variable monitoring is accomplished. The options set in this dialog apply to all browser sessions for the current network. This tab contains the following options:

Report By Exception	Updates the display only when the data changes.
Poll Interval	Determines how often the network variable is polled (in seconds) when a monitored network variable is polled. When a monitored network variable is bound to the browser (see *Network Variable Properties: Monitor Options*), this option determines how often the display is updated.

Browser Options: Remote Lightweight Client Properties

This tab contains options that affect the operation of LonMaker as a remote lightweight client. See *Using the LonMaker Tool on a Remote Lightweight Client* for more information on operating as a remote lightweight client. The options set in this dialog apply to all browser sessions for all networks. This tab contains the following properties:

Server Network Name	Displays the name of the network on the LNS Server to which this LonMaker client is currently attached.
Server Address	Displays the address and port of the IP server to which this LonMaker client is currently attached.
Data Server Mode	Sets the monitoring and control mode for the browser.

	In *Exclusive* mode, a separate data point is created for every remote client which is monitoring a given network variable, and each client has total control over how that data point is monitored (for example, the remote lightweight client can control the polling interval, the data format, and so on). In *Shared* mode, a single data point is created for all shared-mode clients monitoring a given network variable. Monitoring options are set on the host and cannot be changed by the remote lightweight client.
Exclusive Mode Event Interval	Sets the rate at which updates are delivered to this remote lightweight client.

Binding Network Variables to the Host

You can bind network variables to the LonMaker host to receive event-driven updates for monitoring. Event-driven updates are ideal for inputs that change infrequently such as digital sensors, whereas polling is better suited for rapidly changing values such as analog sensors. You can set up event-driven updates using the LonMaker Browser, as described in *Using Bound Updates*. The method described there implicitly creates a new network variable on the LonMaker host for each network variable to be monitored using bound monitoring. If a network variable or connection cannot be created, bound connections are not used and no error message is displayed.

To optimize host network variable usage, it is better to bind many network variables into a single host network variable. This is called a *fan-in connection*. For example, in a system containing several thousand devices, each of which has an output network variable that indicates its alarm state, separate connections between each of these network variables and the host would consume a significant amount of system resources. It is more efficient to create just one network variable on the host and bind all of the output network variables to it. Network variables bound to the host may be monitored by an LNS application such as the LNS DDE Server. LNS allows the individual network variables to be monitored, even though they are received on the same network variable input on the host. Therefore, there is no disadvantage to using a fan-in connection. To differentiate between the different inputs, LNS applications should monitor the network variables on the remote devices instead of the network variables created on the LonMaker computer. LNS automatically uses event-driven updates if a connection to the LonMaker computer exists.

To create a network variable on the host, follow these steps:

1. Ensure that the functional blocks that you want to bind to the host have been created, including a virtual functional block for the local network service device. See *Creating a Functional Block* in Chapter 4, *Creating Networks*.
2. Drag an Input Network Variable shape from the LonMaker Basic Stencil to the virtual functional block of the network service device. The Choose a Network Variable dialog appears.
3. Click **Create NV**. Create one or more dynamic network variables as described in *Dynamically Creating Network Variables* in Chapter 4.
4. Make *connections* to the new network variable(s). See also *Creating a Connection* in Chapter 4, Creating Networks.

Using the LNS Text Box Overview

The LNS Text Box is an ActiveX control that can be used to monitor the value of any network variable or configuration property in a LONWORKS network. The LNS Text Box can also be used to update any input network variable or configuration property value. The LNS Text Box is used

within a LonMaker drawing, and can access any network variable or configuration property on any device within the LonMaker network.

You can also access an LNS text box from Visio's VBA scripting language, allowing you to create complex operator interfaces within a LonMaker drawing. See the *LNS Text Box help file* for a description of the LNS Text Box properties, methods, and events that can be accessed from VBA.

See Chapter 12 and the *LNS Text Box help file* for more information.

11

Creating and Using Custom LonMaker Shapes and Stencils

This chapter describes LonMaker stencils and the process to create them; creating and using custom master shapes for devices, functional blocks, subsystems, and connections; additional user cells for devices, functional blocks, and routers; and setting user-defined functional block modes and types.

LonMaker Stencils

The LonMaker tool uses Visio *stencils* to speed your network engineering. A stencil is a collection of *master shapes* (also called *masters*) that you can easily reuse in your drawings. To add a master shape to your drawing, you drag the master shape from the stencil to your drawing. The LonMaker tool includes LONWORKS specific master shapes called *LonMaker shapes*. For more information on Visio stencils and master shapes, see your Visio documentation. Stencils allow you to combine multiple shapes into larger master shapes. If you include LonMaker shapes in a master shape, the LonMaker tool saves the configuration of these shapes with the master shape, including information such as device template name and configuration property settings. This allows you to create master shapes that represent, for example, all of the functional blocks in a device, or all of the devices in a subsystem. You can also create a master shape that is based on a single shape.

You can save custom stencils you create for a specific network in the drawing folder of that network. If you create a custom stencil to use across many networks, you can save it to a global location such as the LONWORKS lonmaker\visio directory (c:\lonworks\lonmaker\visio by default).

You can create custom LonMaker stencils to further customize the LonMaker tool. See *Creating a Custom LonMaker Stencil* for more information.

Creating a Custom LonMaker Stencil

To create a new custom LonMaker stencil, follow these steps:

1. Open the **File** menu, point to **Stencils**, and then select **Blank Stencil**. This opens a blank stencil with the default name of Stencil1.
2. Create new LonMaker master shapes as described in *Creating Custom LonMaker Master Shapes*.
3. Right-click the title bar of the new stencil and then click **Save** on the shortcut menu. Select a folder, assign a name for the stencil file, and click **Save**. Save the stencil to the LONWORKS lonmaker\visio directory to easily access it with the open stencil ( ) button, or save the stencil to the drawing folder for simplified backup.

Creating Custom LonMaker Master Shapes

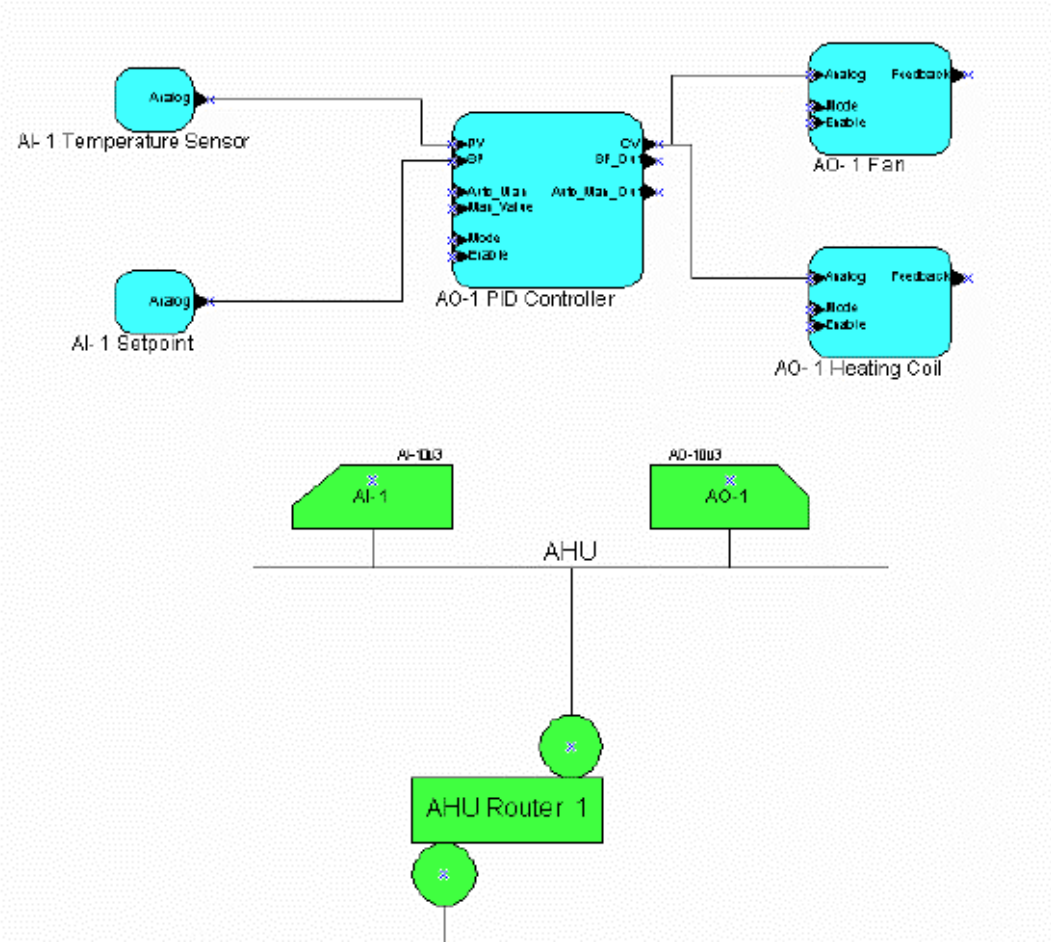
You can create a custom LonMaker master shape to reuse any part of a design within the same drawing or in many LonMaker drawings. To create a master shape, you must first open a stencil as an original file, with read/write access. Normally, stencils open with read-only access. To work with a read/write stencil while maintaining the original, open a copy of the original.

Note: To copy any number of shapes between LonMaker networks, use custom LonMaker shapes as described in this section. Do not hold down Ctrl and drag or use copy/paste between networks.

To open an original stencil, follow these steps:

1. Open the **File** menu, point to **Stencils**, and then select **Open Stencil**. You can also click **Open Stencil** ( ) on the Visio Standard toolbar.
2. Open the folder that contains the stencil and select the stencil.
3. Click the **Open** arrow and then select **Original** to modify the original stencil, or select **Copy** to modify a copy of the original stencil. The stencil window opens, with a red asterisk in the title bar indicating that you can modify the stencil.

Once you have a stencil open for editing, you can create new master shapes in it. You can create a new LonMaker master shape with any number of other LonMaker shapes, as long as all of the shapes are in a single subsystem. For example, you can create a master shape from the router, channels, devices, functional blocks, and connections in the following graphic:



You can include subsystem or supernode shapes in a master shape, and you can include the contents of the subsystems or supernodes in the master shape.

Using Custom LonMaker Master Shapes

You can reuse a custom LonMaker shape that you create (see *Creating Custom LonMaker Master Shapes*). The custom LonMaker master shape may contain any number of the standard LonMaker shapes described in *Designing LonMaker Networks*. The following sections describe how the LonMaker tool processes each of the standard LonMaker shapes when you include them in a custom LonMaker shape.

Device Master Shapes

You can include one or more LonMaker Device shapes in a custom master shape. Each of these is called a *device master shape*. Each device master shape includes the device template name,

device interface (XIF) file name, and the configuration property settings from the original device. The Neuron ID is not included so that you can reuse the master shape with multiple devices.

When you drag a master shape that includes any devices master shapes to a drawing, a Device wizard appears so that you can select the channel for the new device. You can select the same channel as the original device, another existing channel, or create a new channel. If the custom master shape includes multiple devices on the same channel, the Device wizard appears for the first device only on each channel. The LonMaker tool places all subsequent devices that are on the same channel in the master shape on the channel that you select for the first device on the channel, and have their properties set as specified in the master shape. If you want to manually set the channels and properties for each device, set **Force Wizard Prompts** on the *Network Properties>LonMaker Options>General* dialog.

When you drag a master shape to a drawing, the LonMaker tool does the following for each device master shape:

1. If the master shape includes a program ID in a ProgramID user cell (see *Additional Device User Cells*), the LonMaker tool looks up the device template using the program ID. If the master shape does not include a program ID but includes a device template name in a TmplName user cell (see *Additional Device User Cells*), it looks up the device template based on the specified device template name.
2. If the LonMaker tool does not find a device template in step 1, it looks for the device interface (XIF) file specified in the XifName user cell. If the device interface file is found, the LonMaker tool looks up the device template by the program ID specified in the device interface file. If a device template with a matching program ID is found, the user is given the option of changing the name of the device template to the name specified by the device shape, or using the existing device template name. In either case, the existing device template is associated with the device shape.
3. If the LonMaker tool does not find a device template in steps 1 and 2, but it does find the device interface file, it creates a new device template by importing the device interface file. The LonMaker tool gives the new device template the name specified in the device shape, and associates it with the device shape.
4. If the LonMaker tool does not find a device template or device interface file in steps 1 through 3, it prompts you to select an existing device template or to define a new device template by importing a device interface file. The resulting device template is associated with the device shape.

A functional block shape may include a device template name and/or program ID. The device template name assigned by the above procedure must match the name in any functional block shapes that will be used with the newly created device shape. See *Additional Functional Block User Cells* for more information.

Functional Block Master Shapes

You can include one or more LonMaker Functional Block shapes in a custom master shape. Each of these is called a *functional block master shape*. Each functional block master shape includes the device template and/or program ID as well as the network variable and configuration property types, formats, and values associated with the original functional block. To eliminate configuration property values, clear **Copy Values on Functional Block Copy**. See *Configuration Property Properties* for more information.

Custom functional block master shapes always apply to the device type for which they were created. For example, if you create a master functional block shape to be used with a LonPoint AO-10 device, that shape can only be used with AO-10 LonPoint devices. To create a functional block shape that can be used with multiple device types, edit the shape as described in *Editing Master Shape User Defined Cells*.

The following conditions apply to functional block master shapes:

- If a custom master shape contains functional blocks, but not their associated devices, you must create the devices to be associated with the functional blocks before dragging the custom master shape to the drawing.
- If you drop a custom master shape containing a functional block and its associated device, the functional block wizard does not appear, i.e. it knows which device it is associated with.
- If a custom master shape contains several functional blocks associated with the same device, but not the device itself, the functional block wizard appears for the first functional block only. You must associate the functional block with its device. The remaining functional blocks are assigned to the same device, unless no more functional blocks of the correct type are available on the device. If you want to be prompted for the device to which each functional block is to be associated, set **Force Wizard Prompts** in the *Network Properties>LonMaker Options>General* dialog.

Subsystem or Supernode Master Shapes

When you create a custom LonMaker shape from a subsystem or supernode shape, the LonMaker tool copies the information for all the devices, functional blocks, connections, routers, channels, and nested subsystems and supernodes to the master.

Note: When creating a subsystem or supernode master shape, the LonMaker tool requires that you name the stencil. If you just created a new blank stencil, save it before creating the creating the master shape.

Note: When creating a subsystem or supernode master shape, the LonMaker tool creates one or more hidden master shapes that are placed in the same stencil as the original master shape. Therefore, you may not copy subsystem or supernode master shapes from one stencil to another.

Connection Master Shapes

You can include one or more LonMaker Connector shapes in a custom master shape. Each of these is called a *connection master shape*. Each connection block master shape includes the connection attributes for the original connection. One connection master shape can represent several connections in your LonMaker drawing, allowing you to quickly and easily establish multiple network connections with one operation.

You can use connection master shapes to:

- Specify a connection with a connection description other than the default connection description. A connection description is a set of properties that apply to a connection, such as protocol service, retry count, priority, and authentication.
- Establish multiple connections in a single operation. For example, instead of dropping several individual Connector shapes to establish multiple connections (digital output to digital input, analog input to analog output, and so on), you can create a connection master shape to represent all these connections. The connection is displayed on the LonMaker drawing as a connection between the functional blocks on which the connections exist.
- Append a connection to an existing reference connection. For example, if you have a reference connection between an input and output network variable representing time, you can create a connection master shape to quickly create connections to additional output network variables representing time.

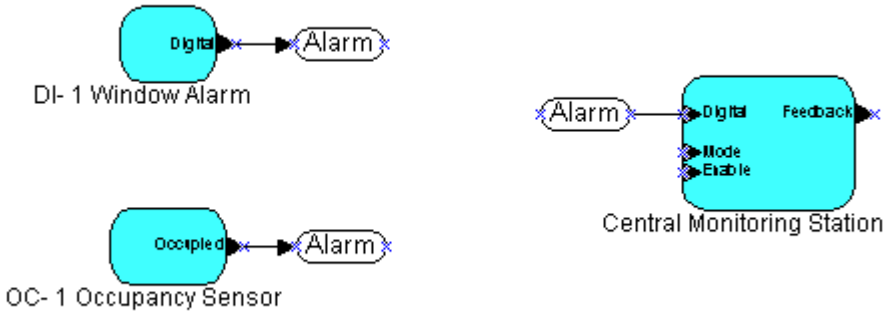
If you include one or more LonMaker Connector shapes in a custom LonMaker master shape, the connections associated with each connector will be saved in the master shape if either of the following conditions are met:

- The functional blocks on both sides of the connection are included.

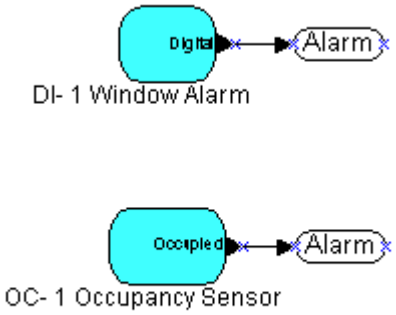
- The master shape contains the connection, reference shape (if any), and the functional block shape.

You can use reference connections in master shapes to create fan-in or fan-out connections. If all of the members in the reference connection are included in a master shape, the LonMaker tool will create a new connection (with a unique reference name) when you drag the master shape to a drawing.

If you create a master shape with only a subset of a referenced connection, (i.e. Functional Block, Connector, and Reference shapes), when you use the master shape the new functional block is added to the same connection as the other reference shapes. For example, assume you have a reference connection as shown in the following figure:



To create a master shape that allows you to fan-in additional inputs to the Central Monitoring Station functional block, copy the following shapes to a new master shape:



If you drag this master shape to any subsystem in the same network, the LonMaker tool creates two new functional blocks, and adds their outputs to the same Alarm connection for the Central Monitoring Station. If you also include the Central Monitoring Station in the master shape, the LonMaker tool creates three new functional blocks and a new reference connection when you drag the master shape to a drawing.

You can also create a master shape containing a connection not attached to any functional blocks. The information in the connection description is saved and becomes part of the master shape. If you create a master shape of a connector and a reference shape (without any associated functional blocks) you can use the master shape to create reference connections without opening the connection dialog.

You can use a master shape that contains reference connections only on the network on which you created it. This is an exception to the general rule that you can use master shapes on more than one network.

Note: To speed up making connections, put your network OffNet before using a master shape with many connections in it. Updates to devices involved in the connections will be done when you go OnNet.

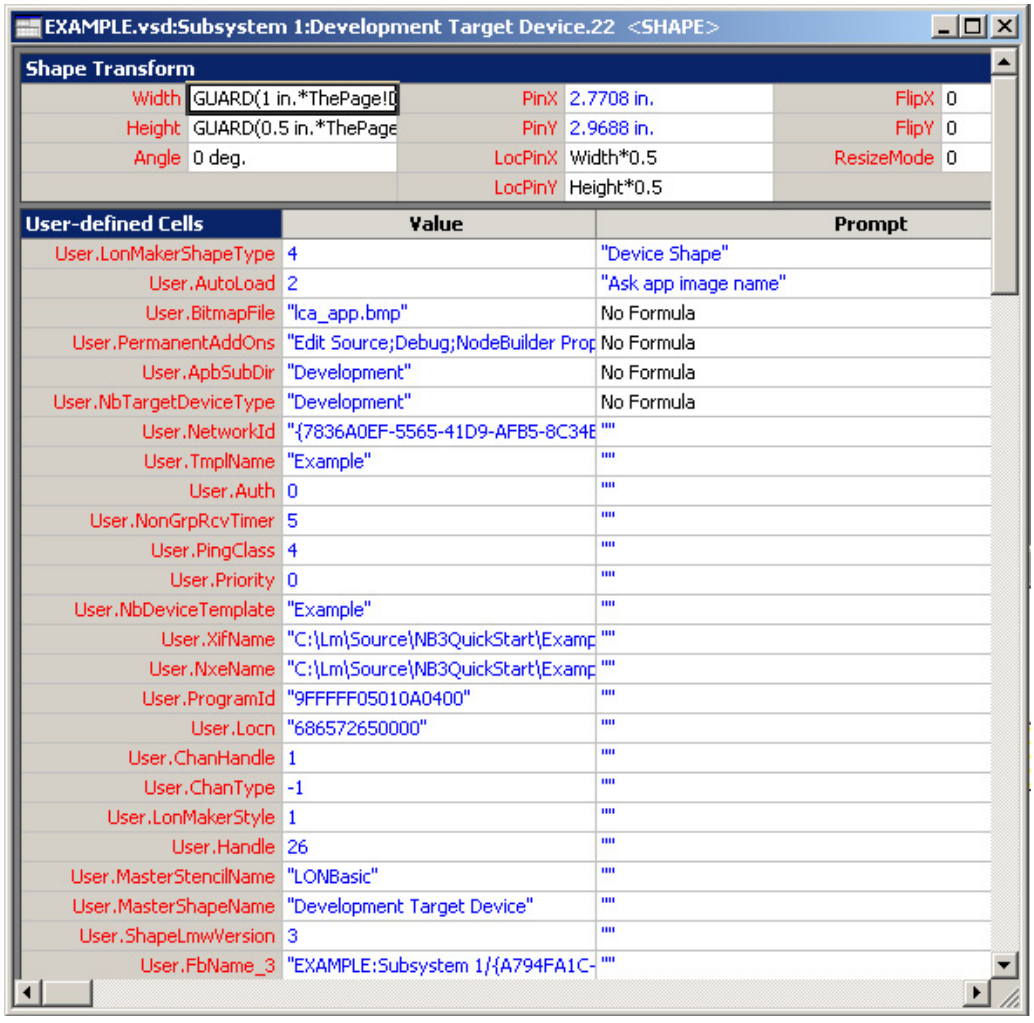
Editing Master Shape User Defined Cells

This section is for advanced LonMaker and Visio users who want to create custom LonMaker shapes for use in their networks.

You can change the properties of a master shape by changing its user-defined cells. For example, you can extend the list of device types to which a functional block can be applied, as described in *Functional Block Master Shapes*.

User defined cells are contained within a page called the ShapeSheet.

To view a shape's ShapeSheet, select the shape, open the Window menu, and select *Show ShapeSheet*. This opens a window similar to the following figure:



Every LonMaker shape has a `LonMakerShapeType` user cell. The value of this cell specifies the LonMaker shape type. The values you are likely to use are the following:

DEVICE 4

FUNCTIONAL_BLOCK 5

FB_NAME 13

You can use the `FB_NAME` value to for a functional block to be contained within a group, which may include other functional block shapes. Set the `LonMakerShapeType` value to 13 for the shape in the group whose text reflects the functional block name.

You can create custom functional block master shapes with network variables by creating a functional block instance in the LonMaker tool, adding the appropriate network variables, and then dragging the shape to a stencil.

Additional Device User Cells

You can include the following are additional user cells in a device shape. Not every device has all of these cells, but you can add them by right-clicking an existing user-defined cell and selecting `Insert Row`

`Auth`	A value of 1 indicates that authentication will be enabled for devices created from this master shape.
`AutoLoad`	Indicates whether an application will automatically be loaded into the device when the device is commissioned or replaced. A value of 0 indicates no, 1 indicates yes, and 2 indicates that the LonMaker user will be prompted. The default value is 2.
`ChanTypeList`	A semicolon-separated list of valid channel type IDs for the device. A value of –1 in the list indicates that the user has the option of selecting from all channels in addition to the channels of the specific types defined. Channel type IDs correspond to the ChannelTypeNumber values contained in the StdXcvr.xml file available from www.lonmark.org. By default, all channel types are allowed.
`EditAdvPropCap`	Specifies handling of the advanced properties tab in the device properties dialog. A value of 0 specifies that the advanced properties dialog is not to be displayed; 1 indicates that the dialog is to be displayed, but cannot be modified; and 2 indicates that the dialog is displayed and changes can be made. The default is to display the advanced properties and allow changes.
`EditPropCap`	Specifies handling of the basic properties tab in the device properties dialog. A value of 0 specifies that the basic properties dialog is not to be displayed; 1 indicates that the dialog is to be displayed, but cannot be modified; and 2 indicates that the dialog is displayed and changes can be made. The default is to display the basic properties and allow changes.
`FbModes`	Specifies a semicolon-separated list of the scopes for each of the functional blocks in this device. This cell's data must be ASCII text in the format <scopeSelector0>**;**<scopeSelector1>**;**... where scopeSelector0 applies to the functional block with index 0 (the Node Object), scopeSelector2 applies to the functional block with index 1, and so on. You can see what functional block in a device has what index by right-clicking the device, selecting Properties from the short-

cut menu, and browsing to the Functional Blocks tab of the device properties dialog.

If this cell is not specified, the LonMaker tool uses scope 0 for functional profile numbers 1–19999, and scope 3 for all other functional profiles. This means that functional block shapes based on user functional profiles with numbers of 20000 and above, as well as all inherited profiles, must either set this value or must include a plug-in that sets the appropriate value.

The scope selector definitions are:

0 Standard functional profile defined in the standard type file set.

3 User-defined functional profile, defined in a manufacturer-specific resource file set.

4 User-defined functional profile, defined in a manufacturer and device class specific resource file set.

5 User-defined functional profile, defined in a manufacturer and device class/subclass specific resource file set.

6 User-defined functional profile, defined in manufacturer, and device class/subclass/model number specific resource file set.

See *Setting User Functional Block Scopes and Types* for more information.

`InitOnline` Specifies the initial state of the device application when it is first commissioned. A value of 0 indicates that the device is to be placed offline; 1 indicates the device is to be placed online; 2 specifies that the device is to be disabled (only applies to devices with a Node Object functional block, otherwise they are placed offline); and 3 indicates that the device's initial state will be set based on the default value set in the *Network Properties: LonMaker Options: Device* dialog. The default is to use the network properties value.

`InstallMethod` A value of 0 causes service pin installation to be the default; 1 causes manual installation to be the default.

`LmwStyle0` Specifies the coloring style applied to a device shape when it is in the Updates Pending state. The default style is Node Uninstalled.

`LmwStyle1` Specifies the coloring style applied to a device shape when it is up-to-date. The default style is Node Normal.

`LmwStyle3` Specifies the coloring style applied to a device shape when it is in the Update Failed state. The default style is Node Error.

`LmwStyle7` Specifies the coloring style applied to a device shape when the LonMaker tool detects that it is detached from the network.

`LmwStyle8` Specifies the coloring style applied to a device shape when the LonMaker tool detects it to be in an unexpected state.

For further information about Visio styles, see the Visio documentation.

`Locn` A 12-digit hex string that specifies the default value of the device's location string. By default, the location string is initialized to all 0's.

`NewAdvPropCap` Specifies handling of the advanced properties dialog in the new device wizard. A value of 0 specifies that the advanced properties dialog is not to be displayed; 1 indicates that the dialog is to be displayed, but cannot be modified; and 2 indicates that the dialog is displayed and changes can be made. The default is to not display the advanced properties.

`NewPropCap` Specifies handling of the basic properties dialog in the new device wizard. A value of 0 specifies that the basic properties dialog is not to be displayed; 1 indicates that the dialog is to be displayed, but cannot be modified; and 2 indicates that the dialog is displayed and changes can be made. The default is to display the basic properties and allow changes.

`NonGrpRcvTimer` Specifies the default non-group receive timer; a value of -1 indicates that the LNS default value will be used. Otherwise, the value is encoded as follows:

Encoded Value	Seconds
0	0.016
1	0.024
2	0.032
3	0.048
4	0.064
5	0.096
6	0.128
7	0.192
8	0.256
9	0.384
10	0.512
11	0.768
12	1.024
13	1.536
14	2.048
15	3.072

`NxeName` File name or full path of the application file. If not specified here, the LonMaker user will be prompted for an application file when a request is made to load the application image.

`ObjStateStyle` Specifies whether the coloring style is applied to the shape's fill, line, text, or a combination of the three. A value of 1 indicates that the style applies to the shape's lines, a value of 2 indicates that the value applies to the shape's fill, and a value of 4 indicates that the style applies to the shape's text. You can add values together to specify combinations; for example, a value of 6 indicates that the style applies to the shape's fill and text but not its lines. By default, the style applies to all three shape attributes.

`PingClass` A value of 0 causes the default ping interval to be used for this shape; 1 causes the `1 minute` ping interval to be used; 2 causes the `2 minute` ping interval to be used; 3 causes the `15 minute` ping interval to be used; and 4 causes the `Never` ping interval to be used.

`Priority`	A value of 1 indicates that priority will be enabled for devices created from this master shape.
`ProgramId`	Device program ID. The LonMaker tool uses this value first to find the device template by name. If not specified, the TmplName value is used.
`RequiresVFB`	Specifies whether the device supports a virtual functional block. A value of 0 indicates the device does not support a virtual functional block; 1 indicates it does support the virtual functional block; and –1 indicates that the LonMaker tool should determine this value based on the device's set of network variables, configuration properties, and message tags. The default is 1.
`TmplName`	Device template name. This must be specified if XifName is specified. Be sure to specify a unique device template name for each unique device interface file. If the LonMaker tool does not first find a device template based on the ProgramId value, it uses the value in TmplName to look up the device template by name. If neither is found, the LonMaker tool searches for a device interface file based on the XifName value and the XIF search path. If found, the XIF file is loaded and used. If not found, the LonMaker user is prompted to enter a device interface file when the device master shape is dragged to the network.
`XifName`	File name or full path of the device interface (XIF) file. If not specified here, the LonMaker user may be prompted for a device interface when the device master shape is dragged to the network, depending on the ProgramId and TmplName values.

Additional Functional Block User Cells

You can include the following additional user cells in a functional block shape. Not every functional block has all of these cells, but you can add them by right-clicking an existing user-defined cell and selecting `Insert Row`.

`DevProgIDList`	Specifies a semicolon-separated list of program IDs that are valid for this functional block. If both DevProgIDList and DevTypeList values are specified, the DevTypeList value takes precedence.
`DevTypeList`	Specifies a semicolon-separated list of device types (device template names) that are valid for this functional block. If both DevProgIDList and DevTypeList values are specified, the DevTypeList value takes precedence.
`FbInstanceList`	Specifies the functional blocks on each device type that are valid for this functional block shape. This cell can be used to futher restrict which functional blocks are valid beyond what is possible with the FbTypeList user cell. The syntax is `<i1>,<i2>..<in>;<j1>,<j2>,..<jn>;...` where the sequence of the semicolon-separated lists corresponds to the device types specified in either the `ProgIdList` or `DevTypeList` fields (the `ProgIdList` field has precedence when both are defined). The comma-separated list indicates the indices of the valid functional blocks for that device type.
`FbTypeName`	Specifies the functional profile name for this functional block, e.g. "Open loop sensor object."

`FbTypeList` Specifies a semicolon-separated list of functional profiles that are valid for this functional block shape. This cell's data must be ASCII text in the format <scopeSelector>**:**<profileNumber>**;**<scopeSelector>**:**<profileNumber>**;**.... The scope selector definitions are:

- 0 Standard functional profile defined in the standard type file set.
- 3 User-defined functional profile, defined in a manufacturer-specific resource file set.
- 4 User-defined functional profile, defined in a manufacturer and device class specific resource file set.
- 5 User-defined functional profile, defined in a manufacturer and device class/subclass specific resource file set.
- 6 User-defined functional profile, defined in manufacturer, and device class/subclass/model number specific resource file set.

See *Setting User Functional Block Scopes and Types* for more information.

Additional Router Shape User Cells

You can include the following additional user cells in a router shape. Not every router has all of these cells, but you can add them by right-clicking an existing user-defined cell and selecting `Insert Row`.

`Class` Specifies the type of router. Valid values are:

0: configured router
1: learning router
2: repeater
3: bridge
4: permanent repeater
5: permanent bridge.

The default and recommended value is 0 for a configured router.

The router shape supports the following fields defined for device shapes: `Auth`, `Priority`, `PingInterval`, `InstallMethod`, `BitmapFile`, `ChanTypeList`, `Locn`, `NewPropCap`, `NewAdvPropCap`, `EditPropCap`, `EditAdvPropCap`, and `InitOnline`. In addition, the router shape has the following fields you can use to specify defaults for Side B of the router.

`PriorityB` A value of 1 indicates that priority will be enabled on the B side for shapes created from this master shape.

`ChanTypeListB` A semicolon-separated list of valid channel type IDs for the device as described in the ChanTypeList device user cell.

Setting User Functional Block Scopes and Types

All functional blocks have scope selectors, which specify the context in which the network variables and configuration properties are interpreted. The scope selector provides a reference to a resource file set that defines data types and display formats. Scope selector 0 is a reference to the LONMARK standard resource file set. If you are developing devices with user functional blocks, network variables, or configuration properties, you may need to set new scope selectors for the functional blocks within your devices.

You can change a scope selector by creating a custom device master shape or by creating a device plug-in that sets your scope selectors. To set the scope selector using a custom device master shape, create a master shape for your device, and then create and set an `FbModes` user cell that sets the scope for each functional block as described in *Additional Device User Cells*.

Adding a Bitmap to the Device Master Shape

You can change the appearance of a device master shape by adding any bitmap to the shape and optionally changing its name. When you add a bitmap, you can leave part of the original form of the shape open so that a LonMaker user can see the fill style that the LonMaker tool uses to represent the device state.

To add a bitmap to a master device shape, follow these steps:

1. Open a new (non LonMaker) drawing in Visio, open the LonBasic stencil (select Stencils, then LonMaker Basic Shapes from the File menu), and then drag the Device shape to the drawing.
2. From the **Edit** menu, select **Open Device**. The Group window opens for the device.
3. Select **Picture** from the **Insert** menu and select a bitmap file. Position the bitmap on the device as desired. Close the Group window.
4. Right-click the bitmap subshape, point to **Format**, and then click **Behavior** on the shortcut menu. Clear the three checkboxes under **Selection Highlighting**.
5. Select **Show ShapeSheet** from the **Windows** menu. Set the LockTextEdit cell value in the Protection section to 1 and close the ShapeSheet.
6. Drag the shape to the stencil, or to a new stencil. To change the name of the shape, right-click it, click **Master Properties** on the shortcut menu, modify the name, and then click **OK**.

Viewing and Editing VBA Code Associated with a LonMaker Network Drawing

Each LonMaker network drawing has VBA code associated with it that implements its LonMaker functionality. You should typically not edit this code, as this may cause loss of LonMaker functionality. To avoid unintentional changes to LonMaker's VBA code, and to protect the LonMaker digital signature, the VBA code in the LonMaker templates and drawings has been password protected.

Caution: See *Working with Digital Signatures* in Chapter 2 for information on the consequences on modifying VBA code.

If you wish to view and edit this code, follow these steps:

1. Open the **Tools** menu, point to **Macros**, and then select **Visual Basic Editor**. The Visual Basic development environment opens. You must have Visual Basic installed on your computer to view and edit VBA code.
2. On the left side of the Visual Basic window, open the network project. You will be prompted for a password. The password is `enumerate`.
3. You can view and edit the Visual Basic code associated with this drawing.

12

Creating HMI Applications

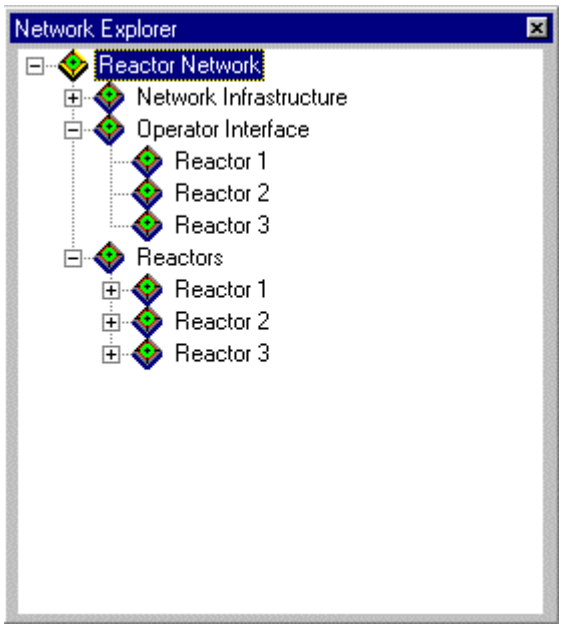
This chapter describes using the LonMaker tool for human machine interface (HMI) applications, the LNS text box, third-party ActiveX controls, and custom LNS-based ActiveX controls.

Using the LonMaker Tool for HMI Applications

You can use the LonMaker tool to build a human machine interface (HMI) for a LonMaker network. An *HMI* is an application that is used to provide an interface for operator input and output. For example, in a LonMaker network that controls a building's HVAC system, the HMI could include real-time temperature readings from each room, as well as an override switch to allow the operator to manually control the heaters and fans.

The LonMaker tool's HMI capability provides a low-cost platform for delivering simple operator interfaces. It is not designed to replace high-end HMI tools such as Wonderware InTouch or Intellution FIX. The LonMaker tool's HMI application is sufficient when you want to, for example, monitor and control states of values or represent repetitive interactions in the network. The high-end HMI tools are best for representing more complex types of network interactions. These tools are developed with a scripting language tuned to specifically address HMI tasks. In addition, these tools offer components that provide reporting and analysis, history, alarm logging, event handling, and Internet-enabling to name a few. See *Using High End HMI Tools with LonMaker Networks* for more information.

When creating an HMI, it is good design to have all of the controls that make up the HMI in a single subsystem that is separate from the subsystems containing the actual network. A single network could contain multiple HMIs. If you have multiple HMI subsystems, it is a good idea to establish a naming convention to correlate each HMI subsystem with the subsystem containing the devices that it represents. These conventions make the system easier to use, modify, and maintain as you add more HMI applications and subsystems to the network. For example, a network that controls several reactors could contain a separate HMI, in a separate subsystem, for each reactor. These HMI subsystems would be completely separate from the devices and functional blocks that made up the reactor design. The following diagram shows a LonMaker Network Explorer view of a network controlling and providing HMIs for three reactors:



If you wish to create an HMI using the tools that are included with the LonMaker tool, you have three options:

1. *Use the LNS Text Box*. You can create a text-based HMI within your LonMaker drawing by dragging one or more LNS Text Box controls from the LonMaker Basic Stencil to a

LonMaker drawing. You can configure each LNS Text Box to monitor and/or control a single network variable, configuration property, or functional block override using a text interface. This method requires no programming of any kind.

2. *Use Third-Party ActiveX Controls*. You can create a graphical HMI within your LonMaker drawing by using the LNS Text Box control to control graphical, third-party ActiveX controls, such as the ComponentWorks controls sold by National Instruments. Using third-party ActiveX controls involves using Visio's VBA scripting language to enable the LNS Text Box controls to communicate with the third-party ActiveX controls.
3. *Create Custom ActiveX Controls*. You can create a graphical HMI using custom controls within your LonMaker drawing by creating your own custom LNS ActiveX controls that are tailored to your devices or systems. These controls may be linked to the LNS Text Box controls as described above. Creating custom ActiveX controls requires knowledge of a programming language that enables you to define COM interfaces, such as Visual C++.

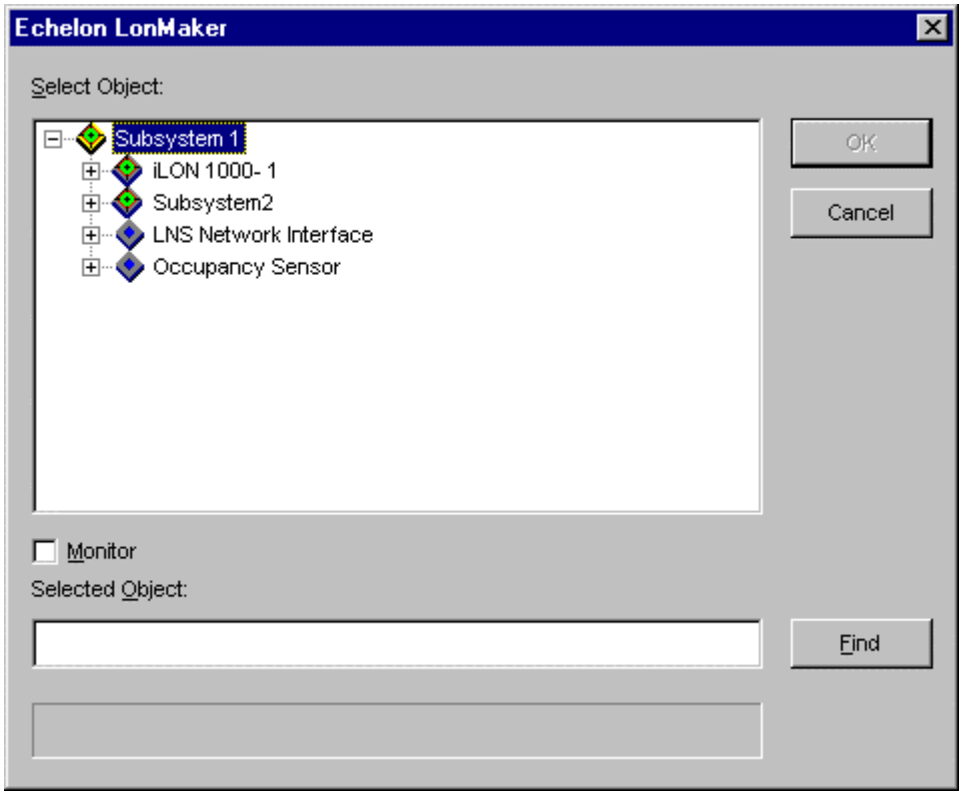
Using the LNS Text Box

You can use the LNS Text Box to monitor and control the value of any network variable, configuration property, or functional block override in a LonMaker network. You can also access an LNS text box from Visio's VBA scripting language, allowing you to create complex operator interfaces within a LonMaker drawing. See *The LNS Text Box Help File* for a description of the LNS Text Box properties, methods, and events that you can access from VBA.

Adding an LNS Text Box

You can add an LNS Text Box to any page of a LonMaker drawing. To add an LNS Text Box, follow these steps:

1. Drag an LNS Text Box Control shape from the LonMaker Basic Shapes stencil to the LonMaker drawing. A dialog may appear informing you that Visio is being put in design mode.
2. Click **OK** if the design mode dialog appears.
3. Right-click the LNS Text Box and then click **Properties** on the shortcut menu. The LNS Text Box Properties dialog appears.
4. Click **Browse** on the LNS Control tab to open a window that allows you to browse through the subsystems, devices, functional blocks, functional block overrides, network variables, and configuration properties in the LonMaker network.



Each device in the tree contains the functional blocks, functional block overrides, network variables, and configuration properties for the device. If you have created a functional block shape in the LonMaker network drawing, the name that you assigned to the functional blocks is displayed; otherwise the default name is displayed. Navigate through the network to select the functional block override, network variable, or configuration property you wish to monitor or control with this LNS Text Box Control. Functional block overrides appear as an Override item under each functional block on a device with a Node Object functional block. The path of the selected network variable or configuration property will appear in the Selected Object field.

5. To monitor the selected functional block override, network variable, or configuration property, set **Monitor**. Clear **Monitor** if you will be using this LNS Text Box to control a functional block override, input network variable, or configuration property.
6. Click **OK** to close the object browser. The path and name of the selected functional block override, network variable, or configuration property appears in **Target Object** on the LNS Control tab.
7. Optionally, set the colors, fonts, border style, and appearance of the LNS Text Box using the Colors, Fonts and General tabs.
8. Click **OK** to close the LNS Text Box Properties dialog.
9. You can move and size the LNS Text box control like other LonMaker shapes. For example, you can cut or copy and paste the control, duplicate it by holding down Ctrl and dragging the text box, or make it into a master by dragging it to a stencil as described in *Creating a Custom Master Shape with the LNS Text Box*.
10. Once you have finished moving and sizing the LNS Text box control, click the **Design Mode** button ( ) on the LonMaker toolbar to return to Run mode. The text box control's value

will not update while you are in design mode, and you will not be able to use the **Get Value** or **Set Value** commands while in design mode.

Creating an LNS Text Box Custom Master Shape

You can create a custom LonMaker master shape from the LNS Text Box, and you can include the LNS Text Box in custom LonMaker master shapes with other LonMaker and Visio shapes. Any properties that you have assigned to the text box—including the object name, colors, and fonts—are saved in the master shape. For example, if you have assigned a functional block override, network variable, or configuration property object to the text box, the object name is saved with the text box in the master shape. After you have created a new text box from a master shape, you can change the assignment by right-clicking the text box and then clicking **Assign Object** on the shortcut menu. Or, you can double-click the text box while in run mode.

If you attempt to use a master shape that has a text box with an assigned object in a new drawing that does not have the corresponding object, the LonMaker tool displays an error message on the text box. Assign the text box to a network variable or configuration property in the new drawing to eliminate the error. Alternatively, you can create the master shape without the object assigned, and bypass this error.

See *Creating New LonMaker Master Shapes* and *Using Master Shapes* for more information on creating and using custom master shapes.

Monitoring a Value with the LNS Text Box

You can monitor any network variable value with the LNS Text Box. To monitor a value, follow these steps.

1. Insert an LNS Text Box in your LonMaker drawing as described in *Installing the LNS Text Box*.
2. Verify that you have selected a network variable.
3. Verify that Visio is in run mode as described in *Installing the LNS Text Box*.
4. Verify that monitoring is enabled by right-clicking a clear space in the current subsystem and ensuring that **Enable Monitoring** is set in the shortcut menu.
5. Right-click the LNS Text Box and then click **Monitor** on the shortcut menu if it is not already set. This will enable the text box to continuously poll the network variable, and display updated values.
6. The text box value is displayed in brackets (<last value>) if it is assigned to a network variable that is not *monitored*. The value displayed within the brackets is the last updated value written to the network variable.

Updating a Value with the LNS Text Box

You can update any functional block override, input network variable or configuration property value with the LNS Text Box. Output network variables cannot be updated. To update a value, follow these steps:

1. Add an LNS Text Box in your LonMaker drawing as described in *Adding an LNS Text Box*.
2. Verify that Visio is in run mode as described in *Adding an LNS Text Box*.
3. Right-click the LNS Text Box and clear **Monitor** on the shortcut menu if it is set. This will stop updates to the text box.
4. Highlight the contents of the LNS Text Box and enter a new value.

5. Right-click the LNS Text Box and then click **Set Value** on the shortcut menu. This updates the functional block override, network variable or configuration property associated with the text box.

Note: If the input network variable that is updated by the text box is also connected to another output network variable, any changes to the output network variable will overwrite the last change by the text box.

Deleting an LNS Text Box

To delete an LNS Text Box from a LonMaker drawing, follow these steps:

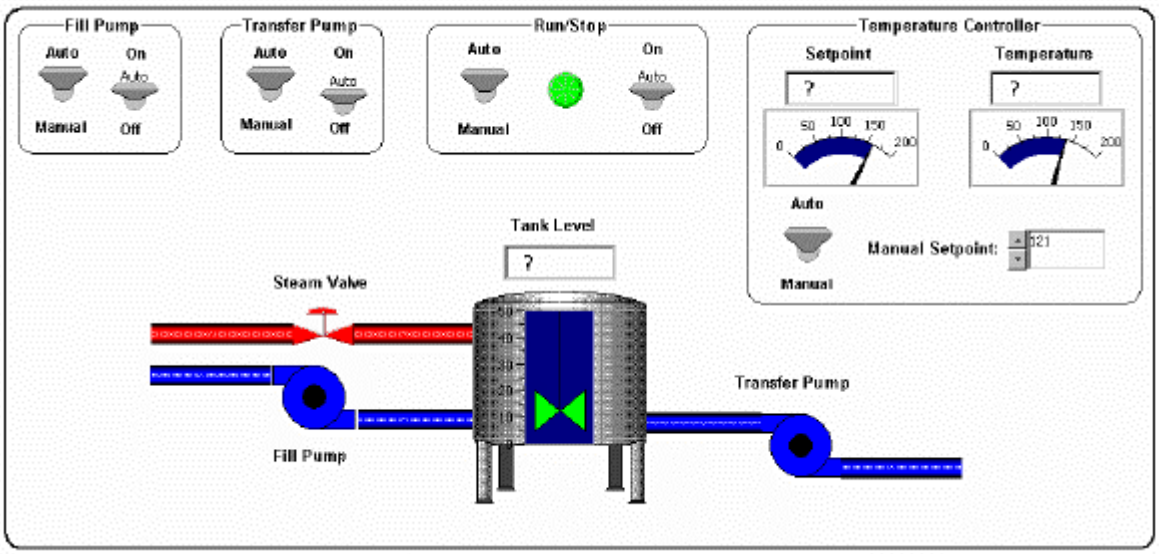
1. Change Visio to design mode if design mode is not already active by clicking the **Design Mode** button ( ).
2. Right-click the LNS Text Box and then click **Delete** on the shortcut menu. If confirmed deletes are enabled, you will see a dialog asking you to confirm the deletion.
3. In prompted, click **Yes** to delete the control.
4. Click the **Design Mode** button on the Developer toolbar to switch back to run mode.

Using a Third-Party ActiveX Control

A third-party ActiveX control is any ActiveX control from a source other than the LonMaker tool, such as the ComponentWorks controls created by National Instruments. They are used to enhance the HMI applications that you create using the LonMaker tool by greatly extending visualization.

Third-party ActiveX controls do not monitor and control network variables and configuration properties directly. Rather, you can configure a third-party ActiveX control to receive functional block override, network variable, or configuration property updates from an LNS Text Box Control or send functional block override, network variable, or configuration property updates to an LNS Text Box Control. Since you can use an LNS Text Box Control to monitor or control a functional block override, network variable, or configuration property, this allows you to use third-party controls for monitoring and control. Communication between a third-party ActiveX control and LNS Text Box Control is facilitated using the VBA scripting language available in Visio.

The following diagram shows an example of an HMI application designed using National Instruments ComponentWorks ActiveX controls:



Inserting a Third-Party ActiveX Control

To insert a third-party ActiveX control in a LonMaker drawing, follow these steps:

1. Drag a Subsystem shape onto a LonMaker drawing and place it within the top-level HMI subsystem.
2. Insert an *LNS Text Box* shape in the drawing. Each third-party ActiveX control you plan to insert must have an associated LNS Text Box control on the same Visio page.
3. Select **Control** from Visio's **Insert** menu. A list of available ActiveX controls is displayed. Select the ActiveX control that you wish to insert into your drawing and click **OK**. The ActiveX control is inserted into your drawing.
4. Some controls do not scale (zoom) well. Therefore, verify that the control that you have chosen will look acceptable if enlarged or decreased in size.
5. Optionally, change the control names on the LNS Text Box and third-party ActiveX control to be more descriptive of the point that it is monitoring or controlling. To change a control name, right-click the control, select the LNS Text Box or third-party ActiveX Control object, then select the second **Properties** from the control object shortcut menu (the first **Properties** will display the properties provided by the control manufacturer). The VBA Properties dialog appears. Click the right-hand column of the Name property, and type the new control name. Close the Properties dialog.
6. Once you have inserted a third-party ActiveX control and a corresponding LNS Text Box control, you can monitor or control a network variable or configuration property value with the third-party ActiveX control as described in *Monitoring a Value with a Third-Party ActiveX Control* and *Updating a Value with a Third-Party ActiveX Control*.

Monitoring a Value with a Third-Party ActiveX Control

You can monitor a functional block override, network variable, or configuration property value using a third-party ActiveX control. To do this, you must write VBA code that receives updates from an LNS Text Box control that is monitoring the desired point and writes it to the third-party ActiveX control. To have an LNS Text Box control send updates to a third-party ActiveX control, follow these steps:

1. Right-click the LNS Text Box that will provide the updates (i.e. monitor the functional block override, network variable, or configuration property), point to **LNS Text Box Control Object**, and then click **View Code** on the shortcut menu.
2. The Visio VBA editor appears. Active Visio drawings are shown in the left pane of the editor. Open the Visio drawing containing the LNS Text Box object. You may be prompted for a password; the password is `enumerate`.
3. The right pane displays the VBA code associated with the document object. Some of the code displayed is the code generated to enable the LonMaker tool to run within the Visio environment, and must not be changed. Typically the only event you should modify is the NvUpdate event. To modify this event, select NvUpdate from the right-hand menu.
4. The cursor will be placed in the NvUpdate event for the LNS Text Box Object you selected. If this is the first time you have modified the code for this LNS Text Box control, this event will be empty. Insert code that updates the appropriate property of the third-party ActiveX control (typically the Value property). Optionally, you can insert code that validates that the LNS Text Box control received a valid value before passing it on to the third-party ActiveX control.

The following code demonstrates how an LNS Text Box control named LmwTankLevel could control a third-party ActiveX control named CWVessel. This code first checks to see if a numeric value was received, and if so, passes it to the third-party ActiveX control:

```
Private Sub LmwTemperature_NvUpdate(ByVal Value as Variant)
      If IsNumeric(Value) Then
            CWVessel.Value = Value
      End If
End Sub
```

Updating a Value with a Third-Party ActiveX Control

You can update a functional block override, network variable, or configuration property value with a third-party ActiveX control. To do this, you must write VBA code that receives updates from the third-party control and writes to an LNS Text Box control that controls the desired point (see *Updating a Value with the LNS Text Box*). To have a third-party ActiveX control send updates to an LNS Text Box control, follow these steps:

1. Right-click the third-party ActiveX control that will provide the updates (i.e. update the functional block override, network variable, or configuration property), point to **Control Object** from the shortcut menu, and then click **View Code**.
2. The Visio VBA editor appears. Active Visio drawings are shown in the left pane of the editor. The right pane displays the VBA code associated with the document object. Some of the code displayed is the code generated to enable the LonMaker tool to run within the Visio environment, and must not be changed. See the documentation for the third-party ActiveX control to determine which event is triggered when the value of the third-party ActiveX control is changed, and select the appropriate event from the right-hand menu.
3. The cursor will be placed in the selected event for the third-party ActiveX control you selected. Insert code that updates the LcaValue property of the LNS Text Box control. Once the value has been set, call the LNS Text Box control's LcaSetValue method to pass the value on to the network variable or configuration property.

The following code demonstrates how a third-party ActiveX control named CWSetPointValue could control an LNS Text Box control named LmwSetPointValue.

```
Private Sub CWSetPointValue_ValueChanged(ByVal Value as
```

```
Variant)
      LmwSetPointValue.LcaValue = Value
      LmwSetPointVaule.LcaSetValue
End Sub
```

Copying LNS Text Box and Third-Party ActiveX Controls

You can copy individual LNS Text Box and third-party ActiveX controls just like any other LonMaker shapes. When you copy an LNS Text Box or third-party ActiveX control, Visio assigns it a default VBA Name property, which you can change by changing the VBA properties for the control.

You can copy an entire set of LNS Text Box and third-party ActiveX controls. For example, a single network controls three identical reactors. Each floor has its own identical HMI, contained in a single subsystem. It is possible to copy the entire subsystem to create the HMIs for the other two floors. Follow these guidelines when you copy multiple controls:

- Copy the subsystem into a new Visio drawing. When you copy a subsystem, a dialog opens that allows you to specify several options related to the subsystem copy. One of these options allows you to place the subsystem copy into a new Visio drawing. If you do not set this option, there will be problems with name conflicts, because all controls must have unique VBA Name properties within a Visio drawing.
- Reassign the names of the third-party ActiveX and LNS Text Box controls. As when individual controls are copied, the VBA Name property of the copies of the controls will be set to a generic name. The code which passes updates from the LNS Text Box to the third-party ActiveX control or vice versa will not be changed (i.e. it will reference the name of the original), so you need to change the Name property of all the controls to the original after the copy has taken place.
- *Use LNS Text Box relative subsystem paths* as described in the LonMaker help file (see the *Using Relative Subsystems with the LNS Text Box* topic). LNS Text Box relative subsystem paths allow LNS Text Box controls in copied subsystems to automatically update the functional block overrides, network variables, and configuration properties they monitor and control.

Creating a Custom LNS-Based ActiveX Control

If you are a software developer, you can create a custom LNS ActiveX control to provide an easier to use and more customized control than is possible with a combination of LNS Text Box controls and third-party controls.

A custom LNS ActiveX control uses LNS services to interact with devices in a LonMaker network. By using LNS services, these controls can access all the devices that are defined within the LonMaker drawing.

A custom LNS ActiveX control contained within a LonMaker drawing runs within the same process as the LonMaker software. Therefore, it must share the same instance of the LNS ActiveX Control that is used by the LonMaker software. When a LonMaker page is opened, the LonMaker software passes the ActiveX interface for the LNS ActiveX Control to all ActiveX controls on the page that are registered with the LMW_LNSBasedControl custom component category. To create a custom ActiveX control, you must first register the ActiveX control and then establish its properties. The registration process and the required ActiveX control properties are described in the following sections.

For more information on implementing your own ActiveX controls, see *Overview: Creating an MFC ActiveX Control Program* in the Microsoft Visual C++ Programmers Guide.

Registering an LNS-Based ActiveX Control

You must register custom LNS ActiveX controls in two phases. The first phase is to register the control class with the Windows registry. This allows the control to be used by any applications that are ActiveX control containers. For example, the following C example registers MyControl in the Windows registry.

```
BOOL CMyControl::CMyControlFactory::UpdateRegistry(BOOL
bRegister) {
// TODO: Verify that your control follows
// apartment-model threading rules.
// Refer to MFC TechNote 64 for more information.
// If your control does not conform to the
// apartment-model rules, then you must modify the
// code below, changing the 6th parameter from
// afxRegInsertable | afxRegApartmentThreading to
// afxRegInsertable.

BOOL retval;

if (bRegister) {
      retval = AfxOleRegisterControlClass(
            AfxGetInstanceHandle(), m_clsid, m_lpszProgID,
            IDS_MYCONTROL, IDB_MYCONTROL, afxRegInsertable
            | afxRegApartmentThreading, dwApartmentOleMisc,
            _tlid, _wVerMajor, _wVerMinor);

      // TODO: Add the code here to register the control
      // as implementing the LMW_LNSBasedControl component
      // category (see example below)
      :
      :
} else
      retval = AfxOleUnregisterClass(m_clsid,
                  m_lpszProgID);

return retval;
```

The second phase is to register the custom LNS ActiveX control as implementing the LMW_LNSBasedControl custom component category. This custom component category is identified by the category ID (CATID) defined below:

```
const CATID CATID_LMW_LNSBasedControl
            = {0xcda4d7e2, 0xee16, 0x11d3, {0xb4,
            0xde, 0x9a, 0x79, 0x8, 0x40, 0x90, 0x3f}};
```

In the custom control registry, the *Implemented Categories* entry must include the `CATID_LMW_LNSBasedControl subkey`. This subkey is added below the CLSID of your custom control as shown in the following example:

```
HKEY_CLASSES_ROOT\CLSID\{123445678-…}
```

```
;CATID for "Insertable
\Implemented Categories\{40FC6ED3-2438-11CF-A3DB-
080036F12502}
;CATID for "Control
\Implemented Categories\{40FC6ED4-2438-11CF-A3DB-
080036F12502}
;CATID for "Custom LNS ActiveX Control.
\Implemented Categories\{CDA4D7E2-EE16-11D3-B4DE-
9A790840903F}
;any others category that applied to your custom control
:
```

Component category entries can be registered using either explicit registry functions or the COM component category manager. COM's component category manager is exposed as an instantiable COM class (CLSID_ StdComponentCategoriesMgr) that implements the ICatRegister interface for registering category information and the ICatInformation interface for querying category information.

The following code uses the COM category manager to register a custom LNS ActiveX control as implementing the LMW_LNSBasedControl component category:

```
// get the standard category manager
ICatRegister *pcr = 0;
HRESULT hr = CoCreateInstance(
CLSID_StdComponentCategoriesMgr, 0,CLSCTX_ALL,
IID_ICatRegister, (void**)&pcr);
if (SUCCEEDED(hr))

{

// Make sure the HKCR\Component
//Categories\CATID_LMW_LNSBasedControl key is registered
CATEGORYINFO catinfo;
catinfo.catid = CATID_LMW_LNSBasedControl;
catinfo.lcid = 0x0409 ; // english
wcscpy(rgcc[0].szDescription, OLESTR("Custom LNS ActiveX
Control"));
pcr->RegisterCategories(1, &catinfo);

// The custom LNS ActiveX control must be registered as
//implementing the LMW_LNSBasedControl component category
CATID rgcid[1];
rgcid[0] = CATID_LMW_LNSBasedControl;
pcr->RegisterClassImplCategories(
      CLSID_YourLNSBasedControl, 1, rgcid);
pcr->Release();
}
```

Establishing LNS ActiveX Control Properties

Custom LNS ActiveX controls must implement 5 properties. These properties are used by the LonMaker software to pass the interface of the LNS ActiveX Control to the custom control and to optionally enable and disable monitoring, to identify the subsystem containing the control, to identify the user name of the user currently using the control, and to identify or control a data point value. These properties are described in the following table:

Property	Purpose
LcaDispatch	The IDispatch interface for access to the LNS ActiveX Control. From this IDispatch interface you can then invoke any LNS method or use any LNSproperty.
LcaActive	A flag specifying whether LNS monitoring is enabled or disabled. This BOOL value is set to true if monitoring is currently enabled in the LonMaker page. This property is optional.
LcaSubsystemName	A BSTR value that indicates the LonMaker subsystem name where the custom LNS ActiveX control is located. This may be used by the custom LNS ActiveX control to implement subsystem-relative addressing. This property is optional.
LcaUserName	A BSTR that indicates the current login LonMaker user name. This may be used by the custom ActiveX control to limit user access to the control. This property is optional.
LcaValue	A `BSTR` that indicates the current LNS value (Network Variable, Configuration Property, or Override status). For example, if the custom LNS ActiveX control is set to update on input variable or configuration property, this property is used to specify the input value to be set. If the control is set to monitor a network variable, this property is used to store the monitoring value so that it can be retrieved. This property is optional.

Custom LNS-Based ActiveX Control Example

```
BEGIN_DISPATCH_MAP(CMyControl, COleControl)
      //{{AFX_DISPATCH_MAP(CMyControl)
      DISP_PROPERTY_EX(CMyControl, "LcaDispatch",
GetLcaDispatch, SetLcaDispatch, VT_DISPATCH)
      DISP_PROPERTY_EX(CMyControl, "LcaUserName",
GetLcaUserName, SetLcaUserName, VT_BSTR)
      DISP_PROPERTY_EX(CMyControl, "LcaSubsystemName",
GetLcaSubsystemName, SetLcaSubsystemName, VT_BSTR)
      DISP_PROPERTY_EX(CMyControl, "LcaActive",
GetLcaActive, SetLcaActive, VT_BOOL)
      DISP_PROPERTY_EX(CMyControl, "LcaValue", GetLcaValue,
SetLcaValue, VT_VARIANT)
      :
      //}}AFX_DISPATCH_MAP
      END_DISPATCH_MAP()


LPDISPATCH CMyControl::GetLcaDispatch() {
      return m_LcaDispatch;
}


void CMyControl::SetLcaDispatch(LPDISPATCH newValue) {
    // NOTE: When using the Get/Set Property method to
    // pass an interface pointer, the pointer is
    // AddRef-ed before the Set routine, but Released
    // on return.  This isn't the case when the Member
    // Variable Property method is used (the pointer is
    // AddRef-ed but not Released).  So, as we keep a
```

```
    // copy of this pointer, we should also AddRef our
    // copy here.
    if (m_LcaDispatch != newValue) {
        // cleanup and release previous pointer
        if (m_LcaDispatch)
            m_LcaDispatch->Release();

        // assign and reference count new pointer
        m_LcaDispatch = newValue;
        if (m_LcaDispatch)
            m_LcaDispatch->AddRef();

        // clear any prior value
        SetLcaValue(COleVariant(_T("")));
    }
}


BOOL CMyControl::GetLcaActive() {
    return m_LcaActive;
}


void CMyControl::SetLcaActive(BOOL bNewValue) {
    if (m_LcaActive != bNewValue) {
        m_LcaActive = bNewValue;

        // TODO: update monitor state as appropriate
    }
}


BSTR CMyControl::GetLcaSubsystemName() {
    CString strResult (m_LcaSubsystemName);
    return strResult.AllocSysString();
}


void CMyControl::SetLcaSubsystemName(LPCTSTR lpszNewValue)
{
    if (m_LcaSubsystemName != lpszNewValue)
        m_LcaSubsystemName = lpszNewValue;
}

BSTR CMyControl::GetLcaUserName() {
    CString strResult (m_LcaUserName);
    return strResult.AllocSysString();
}


void CMyControl::SetLcaUserName(LPCTSTR lpszNewValue) {
    if (m_LcaUserName != lpszNewValue)
        m_LcaUserName = lpszNewValue;
}

VARIANT CMyControl::GetLcaValue() {
    return COleVariant(InternalGetText());
```

```
      //the LCA Value is the CMyControl text/caption
}


void CMyControl::SetLcaValue(const VARIANT FAR& newValue)
{
    COleVariant vaLcaValue = newValue;

    // change value to textual form
    vaLcaValue.ChangeType(VT_BSTR);
    ASSERT(vaLcaValue.vt == VT_BSTR);
    CString strLcaValue(vaLcaValue.bstrVal);

    // check whether text is different
    if (strLcaValue != InternalGetText()) {
        // set text of the control
        SetTextNoModify(strLcaValue);

        // this is a bound property - notify
        // clients of change
        BoundPropertyChanged(dispidLcaValue);
    }
}
```

Appendix A

LonMaker Credits Order Form

This appendix provides a printed copy of the order form for LonMaker credits. See Chapter 8, LonMaker Credits for information on using and adding LonMaker credits and instructions for using this order form. The order form in this appendix is only for use when you cannot automatically generate an e-mail or printed form as described in Chapter 8.

LonMaker Credits Order Form

YOU MUST FILL IN ALL THE BLANK FIELDS IN THE TOP PART OF THE FOLLOWING FORM, SELECT ONE OF THE BILLING OPTIONS BY FILLING IN A CHECKBOX IN THE BOTTOM PART OF THE FORM, AND FILL IN THE BLANK FIELDS IN THE SELECTED BILLING OPTION. IF YOU ARE ORDERING NO CHARGE CREDITS, YOU MUST FILL IN ONE OF THE CHECKBOXES EXPLAINING THE REASON FOR THE ORDER. A BLANK FIELD IS A FIELD WITH A COLON (":") AT THE END OF THE LINE. IF ANY OF THIS INFORMATION IS MISSING, YOUR ORDER WILL BE DELAYED.

TO: Echelon License Administrator
Email: credits@echelon.com
Fax: +1-408-328-3802 (please use email if available)

FROM: Name:
Company:
Phone:
Fax:
Email:

SUBJECT: Order for LonMaker(tm) Credits (Form 3.1.3)

Please process the following order:

Number of LonMaker credits ordered:

Number of LonMaker credits to be delivered (if less than the quantity ordered):

Product: LonMaker Credits

Model Number: 37100

Price Each:

Total Price:

Following are the list prices. These prices are subject to change. Contact your distributor for current and local pricing. Your distributor may also provide you with an alternate mailing address for this order.

List price: US$5.00

Price for authorized free uses: No charge (see agreement below)

The following serial number and PC key values are filled in automatically by the LonMaker tool when you generate a LonMaker credit order as described in Chapter 6 of the LonMaker User's Guide. You should always use the order form generated by the software, include the entire form, and send the form by email (or fax if email is not available) to ensure that there are no errors in transcribing the serial number and key values.

LonMaker Serial Number:

PC Key:

Select one of the following payment methods and fill in the information for the requested method:

[ ] Credit Card (minimum order of 20 credits)

Type of credit card:

[ ] American Express

[ ] MasterCard

[ ] Visa

Name on the credit card:

Credit card number:

Expiration date:

Authorized by:

Billing Address:

Street 1:

Street 2:

City:

Providence/State:

Postal/Zip Code:

Country:

[ ] Purchase Order (minimum order of 20 credits)

Purchase Order Number:

Authorized by:

Billing Address:

Street 1:

Street 2:

City:

Providence/State:

Postal/Zip Code:

Country:

[ ] No charge evaluation, development, test, support, production, training, or replacement credits (check all that apply). By submitting an order for free credits, you agree that you will use these free credits only for the authorized purposes that you have checked below, and you agree that you will provide Echelon with information as reasonably requested by Echelon to verify that the use of these LonMaker Credits is limited to the authorized uses. There is no minimum order size; maximum order size is indicated below.

[ ] Evaluation use. LonMaker Credits used for evaluating the LonMaker for Windows Integration Tool. Limited to 500 free credits per company per year.

[ ] Internal development and test use. LonMaker Credits used for the development and testing of devices that will solely will be used for development, or that will be shipped in the unconfigured state. Limited to 500 free credits per device type per year.

[ ] Support use. LonMaker Credits used by a support engineer to provide support to a customer using the LonMaker tool. The customer must have paid for the LonMaker Credits used for the customer's devices. Limited to 500 free credits per support engineer per year.

[ ] Production use. LonMaker Credits used for manufacturing test. Devices must be shipped in the unconfigured state. Limited to 1 free credit per manufactured device shipped in the unconfigured state.

[ ] Training use. LonMaker Credits used solely for training. Any devices installed during training must not be used in a production or operational system. Limited to 500 free credits per class.

[ ] Replacement use. LonMaker Credits used to replace LonMaker Credits that were lost due to a PC hardware or software failure. Limited to the number of credits that were lost as a result of the failure.

Your LonMaker credits will be sent to you as an application key that will be sent to you by email or fax.

Appendix B

Installing the PCLTA-10, PCLTA-20, or PCC-10 Drivers

This appendix explains how the PCLTA-10, PCLTA-20, and PCC-10 software and hardware should be installed and configured to function as an LNS network interface for the LonMaker tool.

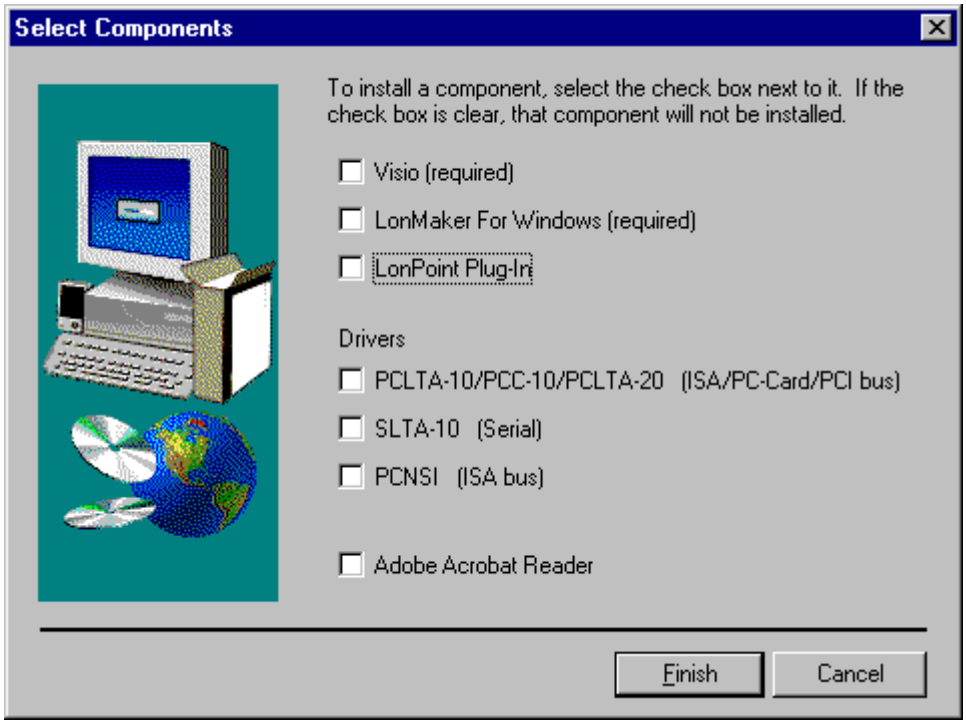
Installing the PCLTA-10, PCLTA-20, and PCC-10 Drivers

The PCLTA- 10, PCLTA- 20, and PCC- 10 installation software installs the files required by the Windows XP, Windows 2000, or Windows 98 operating system to recognize these network adapters. Therefore, you must install the software **before** you physically insert the PCLTA-10, PCLTA-20, or PCC-10 adapter into the computer.

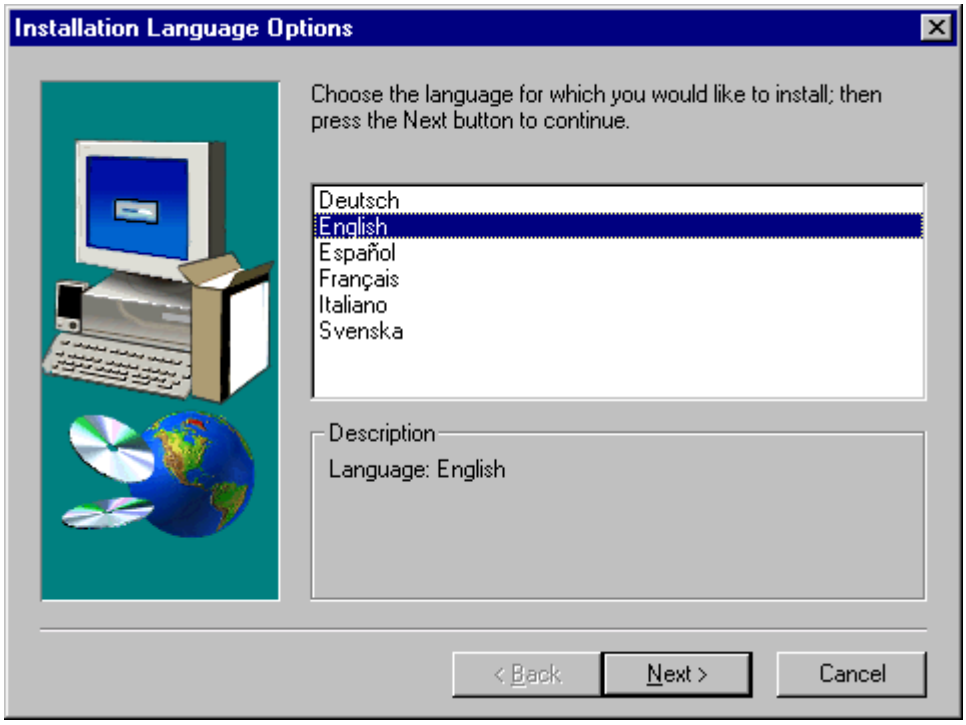
Once you have installed the driver software, you must shut down the computer, install the hardware as described in the appropriate hardware installation section, later in this chapter, and re-start. Then you must run the driver configuration application and perform a diagnostic to ensure the network interface is communicating correctly as described in the appropriate configuration procedure section at the end of this appendix.

To install the driver software on a Windows XP, Windows 2000, or Windows 98 computer, follow these steps:

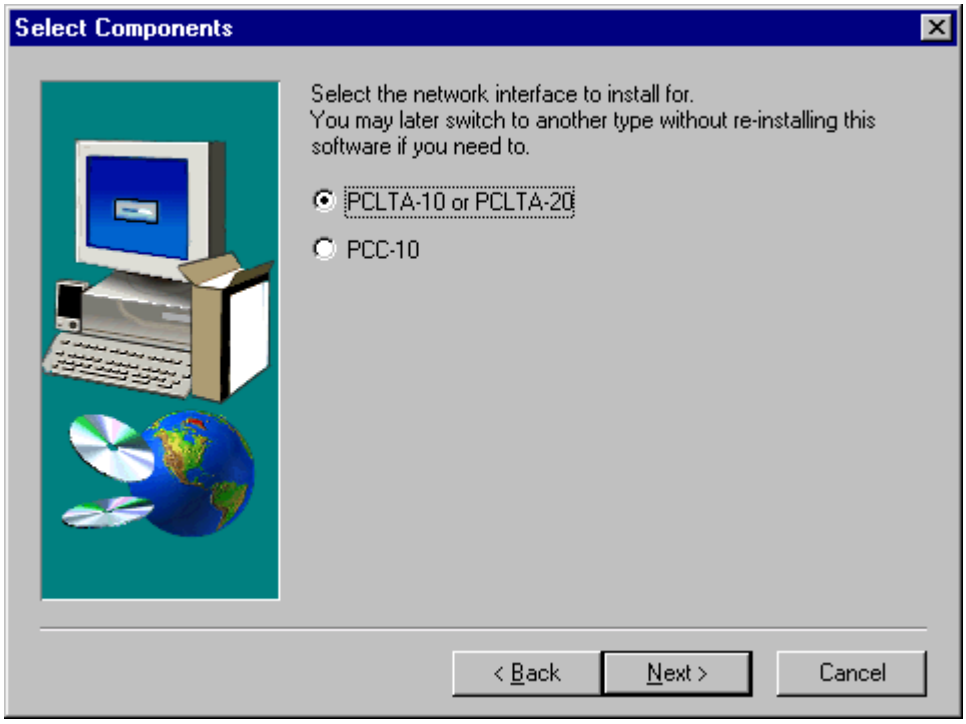
1. Start the installation procedure as described in *Installing the LonMaker for Windows Integration Tool*. The Select Components dialog appears.



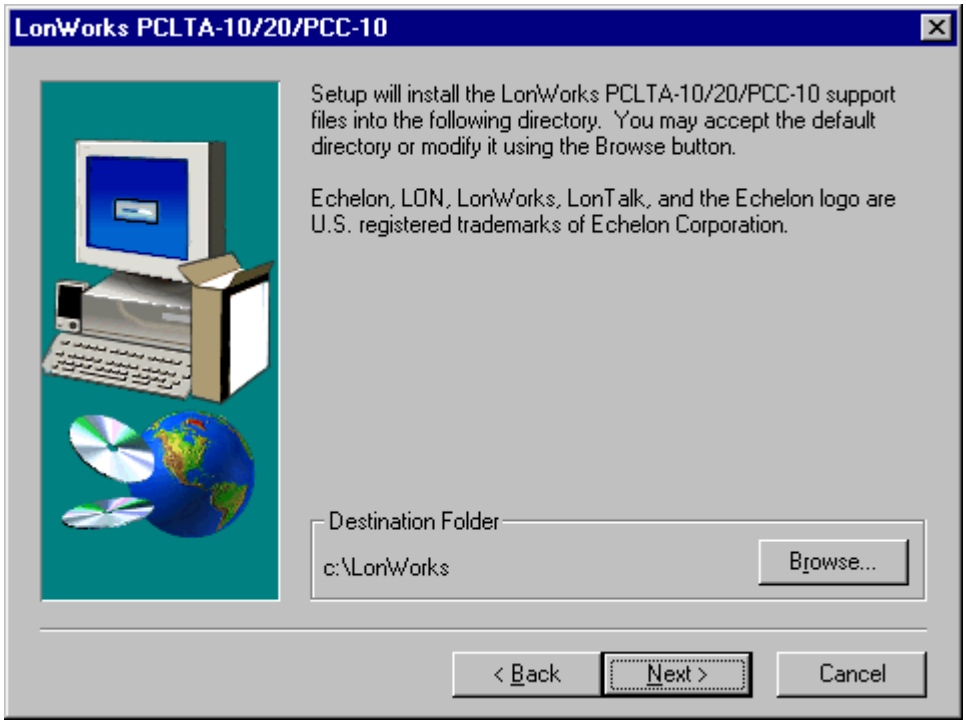
2. Set **PCLTA-10/PCC-10/PCLTA-20** and then click **Finish**. The LonMaker installation program begins. When the installation program enters the driver install phase, the Installation Language Options dialog appears.



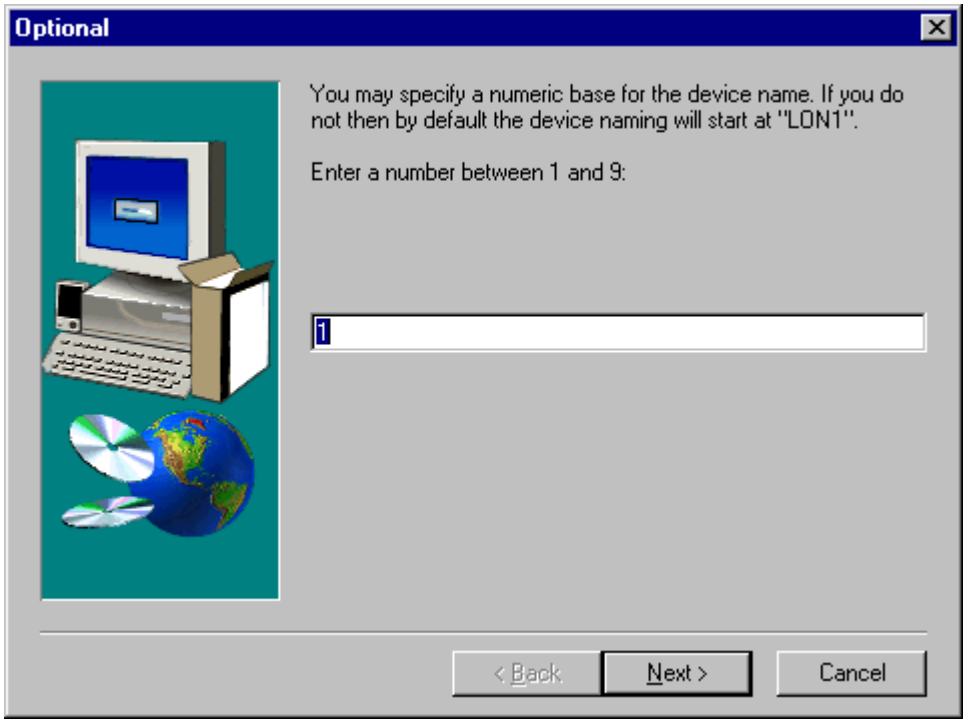
3. Select the language you wish to install and click **Next**. A welcome window appears. Read the information on the welcome window and click **Next**. The software licensing agreement dialog appears.
4. If you agree with the terms of the agreement, click **Yes**. The following dialog appears.


Select Components
Select the network interface to install for.
You may later switch to another type without re-installing this software if you need to.
PCLTA-10 or PCLTA-20
PCC-10
< Back
Next >
Cancel

5. Select the driver to be installed and click **Next**. The following dialog appears.

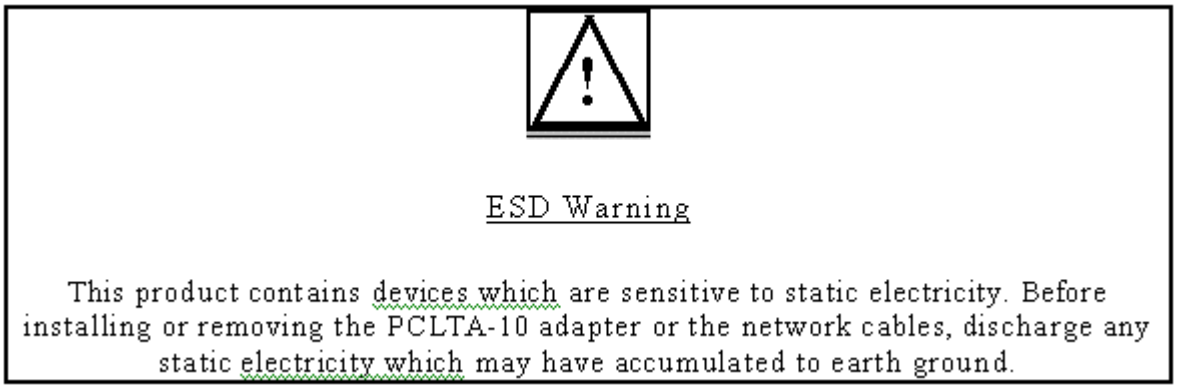

LonWorks PCLTA-10/20/PCC-10
Setup will install the LonWorks PCLTA-10/20/PCC-10 support files into the following directory. You may accept the default directory or modify it using the Browse button.
Echelon, LON, LonWorks, LonTalk, and the Echelon logo are U.S. registered trademarks of Echelon Corporation.
Destination Folder
c:\LonWorks
Browse...
< Back
Next >
Cancel

6. Choose the destination directory where you wish to install the driver. You must choose the same directory you selected for the LonMaker software and the LonPoint Plug-in. If you choose a directory other than C:\LONWORKS, you must specify the image path in the LONWORKS Plug 'n Play control panel in order to use the adapter. Click **Next**. The following dialog appears.


Optional
You may specify a numeric base for the device name. If you do not then by default the device naming will start at "LON1".
Enter a number between 1 and 9:
1
< Back
Next >
Cancel

7. Select a numeric base for your network interface's device name. Click **Next**.
8. The installation program installs the software and displays a dialog that prompts you to view the ReadMe. Check **Yes** to view the ReadMe, and click **Finish**. A dialog appears asking if you want to restart your computer.
9. Click **No**. Be sure to shut down your computer before you install the hardware.
10. Continue with the appropriate hardware installation procedure in one of the following sections.

PCLTA-10 Adapter Hardware Installation Procedure

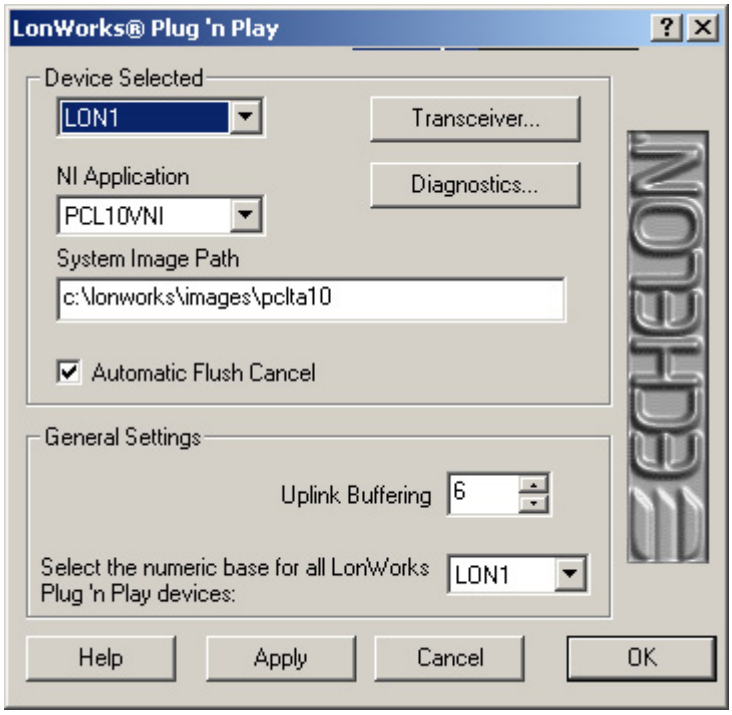

ESD Warning
This product contains devices which are sensitive to static electricity. Before installing or removing the PCLTA-10 adapter or the network cables, discharge any static electricity which may have accumulated to earth ground.

1. Turn off the computer and remove the power cord.
2. Open the computer case and locate an empty 16-bit slot with room for a half-length, half-height ISA-card. Remove the corresponding blank panel from the rear of the computer. Set aside the screw.
3. Insert the PCLTA-10 adapter into the slot, ensuring that the edge connectors are fully mated and the slot in the rear panel-mounting lug of the PCLTA-10 adapter is aligned with the threaded hole in the computer chassis.
4. Replace the screw to hold the PCLTA-10 adapter firmly in place.
5. Reinsert the power cord and then restart the computer. A New Hardware Found window will be displayed briefly when the operating system recognizes the PCLTA-10 adapter.

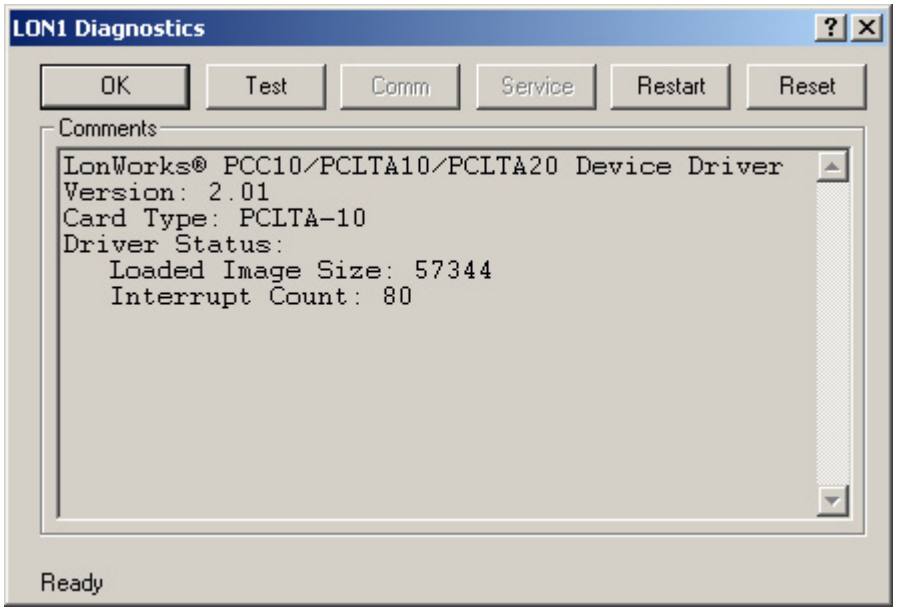
PCLTA-10 Configuration Procedure

Once the PCLTA-10 software and hardware have been installed, you must load the PCC10VNNI firmware image to the PCLTA-10 device. To accomplish this, follow these steps:

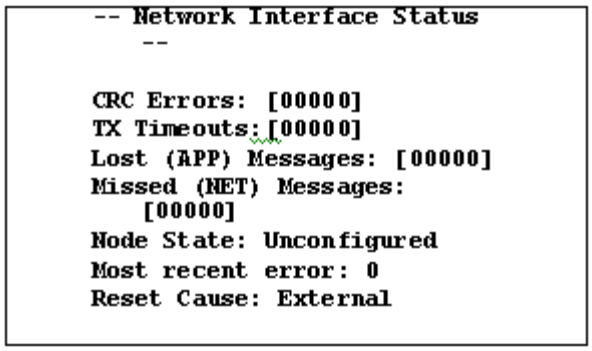
1. From the Windows `Start` menu, select **Settings**, and choose **Control Panel**.
2. Open **LONWORKS Plug 'n Play**. The following dialog appears:



3. Ensure that the System Image Path matches the one used during software installation.
4. Select PCC10VNI in **NI Application** and click **Apply**.
5. Click **Diagnostics**. If the PCLTA-10 software and hardware installation has proceeded correctly, the following dialog appears:



6. Refer to the PCLTA-10 online help if this dialog does not appear.
7. Click **Test**. The following statistics should appear.



If you receive an error message or your system hangs after clicking the **Test** button, uninstall the driver, reboot your computer, reinstall the software, and try running this diagnostic again.

8. If the test passes, you know that the computer can communicate with the PCLTA-10. The next step is to be sure that the interface adapter can communicate with a test device. This is accomplished using the **COMM** button. Choosing this command causes the control panel to prompt with the following:

```
This procedure will configure the Network Interface for a
zero-length domain.  Do you want to proceed?
```

9. Click **OK**. The control panel will enter a receive-ready state and will display the following message while waiting for a service pin message from another device on the network:

10. Now waiting for a service pin message.

11. Press the service pin on any device attached to the same network as the PCLTA-10.

Once you press the service pin on the other device and the control panel receives the service pin message, the control panel sends a request/response diagnostic message to the device originating the service pin message using Neuron ID addressing. It will repeat this operation, referred to as a "ping, once a second until either the OK or the Quit button is chosen" (the **Comm** button becomes the **Quit** button). Results will be displayed similar to the following:

```
Received service pin, pinging node:
  Neuron ID: 01 23 45 67 89 10
  Program ID: A_NODE
** Ping Passed **
** Ping Passed **
** Ping Passed **
...
```

This series of tests is intended to confirm that the network interface card is properly configured and can communicate with a device on the network.

12. Click **OK** to close the dialog, and click OK again to close the LONWORKS Plug N' Play application.

PCC-10 Card Hardware Installation

The PCC-10 card conforms to the Personal Computer Memory Card International Association's (PCMCIA) standard for hot plug-in. The PCC-10 card will not be harmed if it is inserted into, or removed from, a PC Card slot that conforms to this standard, whether the computer is on or off. In addition, the PCC-10 card is recognized as a Underwriter's Laboratories (UL) Listed Accessory and is designed to be used with UL Listed equipment.

Do not force the insertion of a PCC-10 card. You can only insert the PCC-10 card one way into a PC Card slot. The keyed notches prevent the card from being inserted upside down. In Windows

98, insertion of the PCC-10 card may cause Windows to produce two brief tones: a low tone followed by a higher tone. Extracting the card will produce the tones in the reverse order: high, then low. If a device's property window is open in the System Control Panel, the tones will be produced after the window is closed. This confirms that the device is inserted correctly. Additionally, a PC Card icon may also appear in the status area to the right of the Windows taskbar.

If you reboot the computer after installing the software, insert the PCC-10 card into an open PC Card slot. Otherwise, reboot the computer before inserting the card.

Windows does not load the device driver for the PCC-10 card until it discovers the first PCC-10 card. Likewise, when you remove the last PCC-10 card, Windows unloads the device driver, thus freeing any system resources it was using.

Each PCC-10 card requires a single, dedicated interrupt request (IRQ) and four contiguous bytes of I/O address space starting on a modulo-4-based address.

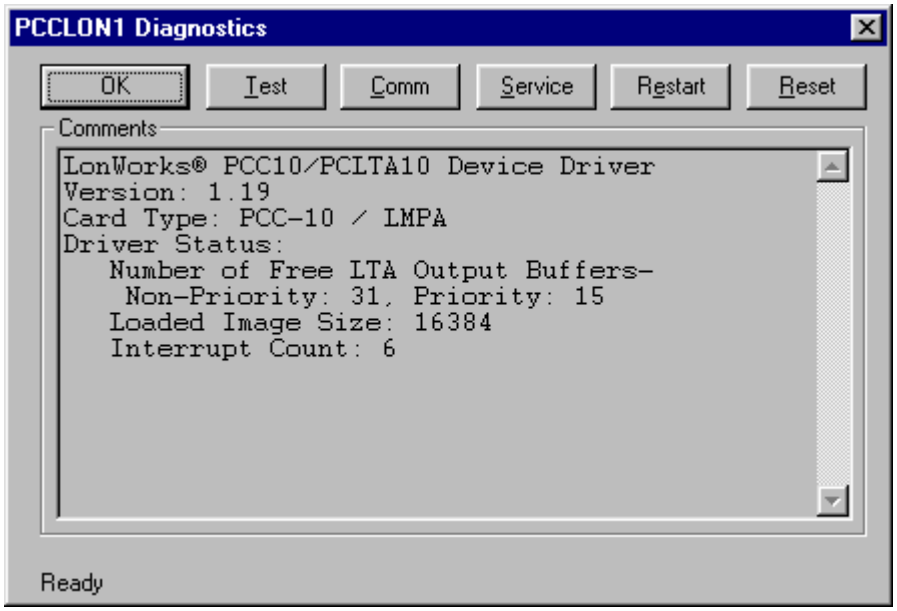
If you remove a PCC-10 card while an application is using the card, Windows will lose communication with the device, which cannot be restored by re-inserting the card. Some applications will display unusual behavior, and will not properly function. Any application using the PCC-10 card must be restarted if a PCC- 10 card has been removed to ensure proper operation of the device and software.

The first time you insert a PCC-10 card into a running computer, a window will appear with the words "Echelon Corp.- PCC-10." Another window will appear stating that the Windows operating system is building a new database from the device information installed by the PCC-10 installation diskette. You can configure the new hardware when the computer has finished writing the device information.

PCC-10 Configuration Procedure

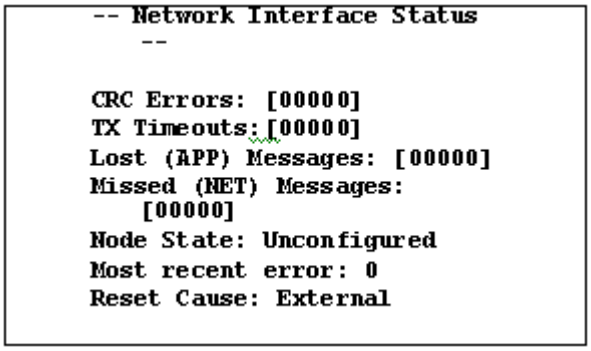
You must load the PCC10VNI firmware image to the PCC-10 device after you have installed the PCC-10 software and hardware. To accomplish this, follow these steps:

1. From the Windows **Start** menu, select **Settings**, and choose **Control Panel**.
2. Open **LONWORKS Plug 'n Play** icon from the control panel.
3. Ensure that the `System Image Path` matches the one used during software installation.
4. Select **PCC10VNI** the NI Application list and then click **Apply**.
5. Click **Diagnostics**. If the PCC-10 software and hardware installation has proceeded correctly, the following dialog appears.



Refer to the PCC-10 online help if this dialog does not appear.

6. Click the **Test** button. The following statistics should appear.



If you receive an error message or your system hangs after clicking the **Test** button, uninstall the driver, reboot your computer, reinstall the software, and try running this diagnostic again.

7. If the test passes, you know that the computer can communicate with the PCC-10. The next step is to be sure that the interface adapter can communicate with a test device. This is accomplished using the **COMM** button. Choosing this command causes the control panel to prompt with the following :

   ```
   This procedure will configure the Network Interface for a
   zero-length domain.  Do you want to proceed?
   ```

8. Click the **OK** button. The control panel enters a receive-ready state and displays the following message while waiting for a service pin message from another device on the network:

   ```
   Now waiting for a service pin message.
   ```

9. Press the service pin on any device attached to the same network as the PCC-10.

   Once you press the service pin on the other device and the control panel receives the service pin message, the control panel sends a request/response diagnostic message to the device

originating the service pin message using Neuron ID addressing. It will repeat this operation, referred to as a "ping, once a second until either the OK or the Quit button is chosen" (the **Comm** button becomes the **Quit** button). Results will be displayed similar to the following:

```
Received service pin, pinging node:
  Neuron ID: 01 23 45 67 89 10
  Program ID: A_NODE
** Ping Passed **
** Ping Passed **
** Ping Passed **
...
```

This series of tests is intended to confirm that the network interface card is properly configured and can communicate with a device on the network.

10. Click **OK** to close the dialog, and click OK again to close the LONWORKS Plug N' Play application.

Appendix C

LonMaker Software License Agreement

This appendix provides a printed copy of the LonMaker Integration Tool Software License Agreement.

LonMaker Software License Agreement

LONMAKER™ INTEGRATION TOOL

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DEFINITIONS

For purposes of this Agreement, the following terms shall have the following meanings:

- "Commission" means to assign and write any part of the LONWORKS® Network Configuration for a LONWORKS® Device.
- "Commissioned Device" means a LONWORKS Device that (i) has a valid LONWORKS Network Configuration and (ii) has an entry in an LNS Server's database.
- "Licensed Software" means all computer software and associated media, printed materials, and online or electronic documentation that accompany the LonMaker Integration Tool product; including, without limitation, any and all executable files, add-ons, stencils, templates, SmartShapes® symbols, filters, tutorials, help files and other files, that accompany such software or are in the accompanying documentation.
- "LonMaker Credits" means credits that are purchased from Echelon or an Echelon-approved LonMaker Credit reseller for the purpose of Commissioning or Recovering more than sixty four (64) (for the "Professional Edition") or up to five (5) (for the "Standard Edition") LONWORKS Devices with the Licensed Software.

- "LONWORKS Network Configuration" means a valid LONWORKS Domain, Subnet, and Node address, as well as valid Group, Network Variable Selector, and Message Tag values, as defined by the LonTalk Protocol.
- "LONWORKS Device" means a product designed for use in a network based upon Echelon's LONWORKS platform, including without limitation LONWORKS Application(s) as set forth in the LONWORKS OEM License Agreement between You and Echelon.
- "Network Service Device" means a LONWORKS Device that is executing the Echelon LNS software as described in the Echelon LNS documentation.
- "Recover" means to read the LONWORKS Network Configuration from a LONWORKS Device and to use such information to create an entry or entries in an LNS Server's database.
- "Remove" means to remove a Commissioned Device from an LNS Server's database, such that no further use by the LONWORKS Device of any part of the LONWORKS Network Configuration that was assigned to the Commissioned Device by the LNS Server is possible.
- "Replace" means to Commission a LONWORKS Device using the LONWORKS Network Configuration from a second LONWORKS Device (the "Replaced Device"), with no further use by the first LONWORKS Device of any part of the LONWORKS Network Configuration in the Replaced Device.
- "Router" means a device that forwards LONWORKS messages between two LONWORKS channels and does not implement layer 7 of the LONTALK Protocol or execute an application other than the routing firmware.
- "You(r)" means Licensee, i.e. the company, entity or individual who has rightfully acquired the LONMAKER Integration Tool.

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Appendix D

Software License Transfer Agreement

If you purchased a license for the LonMaker software, you can transfer the license to another party. To do this, you and the other party must sign the agreement in this appendix.

Software License Transfer Agreement

THIS SOFTWARE LICENSE TRANSFER AGREEMENT is entered into as of _____ [insert date], by and between _____ [insert company name of original purchaser] ("Assignor") and _____ [insert name of company purchasing the software] ("Assignee") for the _____ [insert name of software product being transferred] ("Software").

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IN WITNESS WHEREOF, the parties have executed this Software License Transfer Agreement as of the date first written above.

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Company Name	Company Name
Signed By:	Signed By:
_____	_____
(Print Name)	(Print Name)
Title: _____	Title: _____
Address: _____	Address: _____
City,State/Province, Country, Postal Code	City,State/Province, Country, Postal Code
Telephone: _____	Telephone: _____
(Fax or email address)	(Fax or email address)
Date: _____	Date: _____

For a copy of the appropriate Software License Agreement, call Echelon Corporation at +1-408-938-5200.

Appendix E

Glossary

This appendix provides definitions for many terms commonly used with the LonMaker tool.

Glossary

Term	Definition
Application	Software that controls the operation of a LONWORKS device. The application may be in a device when you purchase it, or you may load it into the device from application files (.apb and .nxe extensions) using the LonMaker tool.
Binding	The process of creating a *connection*.
Channel	See *communications channel*.
Channel type	A specification of communications parameters that enable multiple devices to share a communications medium. The choice of channel type affects transmission speed and distance as well as the network topology.
Communications channel	A physical transport medium for packets. All devices on a communications channel receive every packet transmitted by other devices on the same communications channel. Also called a *channel*. Different transceivers may be able to interoperate on the same channel.
Communication protocol	Rules and procedures governing transfer of information between devices on a network. The protocol defines the format of the message being transmitted between devices and defines the actions expected when one device sends a message to another. A protocol ensures that application data on a source device is correctly received by the applications on one or more destination devices. Also called a *protocol*. The protocol normally takes the form of embedded software or firmware code in each device on the network. LONWORKS devices communicate using the ANSI/EIA/CEA-709.1 standard. Echelon's implementation of this protocol is called the *LonTalk protocol*.
Configuration Property	A data value used to configure the application program in a device. Configuration properties are used to set parameters such as maximum, minimum, default, and override values. They can be implemented using configuration network variables or as data items within configuration files. Configuration property data is kept in a device's non-volatile memory. Configuration properties are set during installation, operation, and maintenance. For example, an application may allow an arithmetic function (add, subtract, multiply, or divide) to be performed on two values received from two network variables. The function to be performed may be determined by a configuration property.
Connection	Network configuration information stored within sending and receiving devices that enables network variable or message tag updates generated by a sending device to be received by a receiving device or group of devices. The device firmware in the sending and possibly the receiving devices is configured to know the logical address of the other devices or group of devices in the network. Connections may be thought of as "virtual wires."
Device template	A specification of the network-visible interfaces to a device. The interfaces include functional blocks, network variables, configuration properties, and message tags. For example, the Echelon LonPoint devices all have associated device templates. When you drag a LonPoint device shape to a LonMaker drawing, the LonMaker tool creates the new device according to that device's template.
Device	See *LONWORKS device*.
Functional block	A portion of a device's application that performs a task by receiving configuration and operational data inputs, processing the data, and sending operational data outputs. A functional block may receive inputs from the network, from hardware

	attached to the device, or from other functional blocks on a device. A functional block may send outputs to the network, to hardware attached to the device, or to other functional blocks on the device. A functional block is an implementation of a functional profile. A standard functional block is also known as a *LONMARK object*. A standard or user functional block is also known as an *object*. For example, a LonPoint DI-10 module has four digital input functional blocks that contain the configuration properties and output network variable for each of the four hardware digital inputs on the DI-10 device.
Local client	A LonMaker tool or other LNS application running on the same computer as the LNS Server.
LONWORKS network	A collection of intelligent *devices* that communicate with each other using the ANSI/EIA/CEA 709.1 protocol over one or more *communications channels*.
Monitor set	A group of monitor points that the LonMaker tool uses to monitor and control network variables.
Network Variable	A data item that a particular device application program expects to get from other devices on a network (an *input network variable*) or expects to make available to other devices on a network (an *output network variable*). Examples are a temperature, switch value, and actuator position setting. Network variable data is typically stored in a device's volatile memory.
Node	See *LONWORKS device*.
OffNet	A management mode for a LONWORKS network where changes to application and network configuration properties are saved in the database and propagated across the network when you next go `OnNet`. After you have been OnNet once, network variables can be changed on the network while working in OffNet mode (after devices have been commissioned and functional blocks have been added, connected, and configured).
OnNet	A management mode for a LONWORKS network where changes to application and network configuration properties are propagated across the network immediately (after devices have been commissioned or functional blocks have been added, connected, or configured)
Protocol	See *communication protocol*.
Remote client	A LonMaker tool or other LNS application running on a different computer than the LNS Server.
Remote full client	A *remote client* that communicates with an LNS Server through a LONWORKS or LONWORKS/IP channel.
Remote lightweight client	A *remote client* that communicates with an LNS Server through an LNS/IP channel.
Remote operation	Use of a *remote client*.
Router	A device that forwards information from one channel to another, based on routing rules. Routers must be configured to enable them to optimize their routing decisions. In normal operations, routers do not store any messages that they route. Routers are used to manage network message traffic, extend the physical size of a channel (both length and number of devices attached), and to connect channels that use different media (transceiver types) together. Unlike other devices, routers are always attached to two channels. LONWORKS/IP routers, such as the Echelon *i*.LON 1000 Internet Server may be used to connect LONWORKS networks to the Internet or IP networks.

Subsystem	A collection of devices, routers, and functional blocks. With the LonMaker tool, each subsystem corresponds to one page within a LonMaker drawing. Subsystems allow you to place devices, routers, and functional blocks onto separate pages for organizational purposes. You can place a subsystem within another subsystem, allowing you to create a subsystem hierarchy for large networks. For example, a network may consist of HVAC, lighting, security, and operator subsystems. These may be further divided into subsystems for each floor, and each floor divided into subsystems for each room.
Supernode	A *subsystem* with a network variable interface. You can use a supernode to organize groups of devices into logical units and to hide complex subsystem details, exposing only the desired network variables. This reduces errors and decreases the time required for network engineering and commissioning. A supernode's network variable interface may contain any network variable on any device found within the supernode or its nested subsystems.

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